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USSR Report

MILITARY AFFAIRS

No. 1791

AVIATION AND COSMONAUTICS

No. 2, February 1983

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Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow.

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KUTAKHOV ARMY-NAVY DAY ARTICLE

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 1-3

[Article by Hero of the Soviet Union Chief Mar Avn P. Kutakhov, commander in chief of the Air Force, USSR deputy minister of defense: "Under the Banner of the Party, United With the People"]

[Text] The date 23 February 1918 -- the day the Soviet Armed Forces were born -- occupies a worthy place among the many important dates which are close to the hearts of the people.

The road traveled by the Soviet Army and Navy is marked by heroic victories, and their combat banners are covered with unfading glory. And the wise leadership of the Communist Party is clearly embodied in each of these victories and in the combat power of our Army, Air Force, and Navy. The USSR Armed Forces have earned warm affection and gratitude on the part of the peoples of our country and the working people of the entire world by their selfless service to the homeland and the fine ideals of communism.

This year this national holiday is being celebrated in an atmosphere of monolithic unity and close solidarity of the Soviet people behind the CPSU and its Leninist Central Committee, and an ardent aspiration on the part of millions of Soviet citizens to implement the historic decisions of the 26th CPSU Congress.

The firmness of the Leninist CPSU policy was demonstrated with renewed force by the November (1982) CPSU Central Committee Plenum, which confirmed the long-range party strategy for the period of the 11th Five-Year Plan and the 1980's as a whole. The plenum proceedings and decisions demonstrated to the entire world that Lenin's concern about the growth of our homeland's economic and defense might, about the Soviet citizen, the conditions of his labor and daily life, as well as his spiritual and intellectual development continues to be a most important CPSU program point. The work of the 7th Session of the USSR Supreme Soviet, 10th Convocation, was permeated with this solicitude.

A warm response in the hearts of Soviet citizens and army and navy personnel was evoked by the speech by CPSU Central Committee General Secretary Comrade Yu. V. Andropov at the November (1982) CPSU Central Committee Plenum. This speech contained a comprehensive analysis of the present state of the Soviet

economy, specified an elaborate program of further struggle to increase the efficiency of the nation's economy, to intensify it, and to improve the entire domain of management and direction of the economy.

The CPSU Central Committee Plenum decisions, Comrade Yu. V. Andropov's speech, and the proceedings of the USSR Supreme Soviet session clearly reflect the grandeur of the productive plans of Soviet citizens and our increased capabilities to achieve technical improvement and greater efficiency of societal production.

The State Plan of Economic and Social Development of the USSR and the State Budget for 1983 contain measures directed toward dynamic development of industry and agriculture, concentration of capital investment, and a further upswing in the economy of each and every Soviet republic, as well as increased efficiency of the entire national economy.

Increase in national income utilized for consumption and accumulation will amount to 3.3 percent, or 15 billion rubles, as compared with 9 billion rubles in 1982. Industrial output volume will increase by 3.2 percent, or by 23 billion rubles, as compared with 20 billion in 1982.

The Food Program ratified by the May (1982) CPSU Central Committee Plenum is a most important component part of the party's economic strategy. It unites the efforts of agricultural workers and workers in related branches of industry, transportation, procurement, and trade for the sake of achieving a common end objective -- to supply the population with all types of foodstuffs and industry with raw materials. Gross agricultural production in 1983 will increase by 13 billion rubles or by 10.5 percent over 1982.

An important place in the State Plan of Economic and Social Development of the USSR for 1983 is occupied by matters pertaining to improving transportation and communications, capital construction, and development of science and technology. As always, the needs of national defense are also taken into consideration to an adequate degree. The party has considered and continues to consider mandatory, especially in the present conditions of a sharp deterioration in the international situation, giving the Army and Navy everything they need. But the Soviet state is not spending and has no intention of spending for defense a single ruble more than is essential to ensure the security of the Soviet people, its friends and allies.

Under the wise, tested and proven leadership of the party, our country's working people, achieving outstanding success in building communism, are devoting all their efforts toward further strengthening the economic and defense might of the homeland. "The Soviet people have total trust and faith in their Communist Party," CPSU Central Committee General Secretary Comrade Yu. V. Andropov emphasized in his address at the Special Plenary Session of the CPSU Central Committee on 12 November 1982. "They trust it because it has not had and does not have any other interests than the vital interests of Soviet citizens. To justify this faith means to advance along the road of building communism, achieving further flourishing of our socialist homeland." The celebrations honoring the 60th anniversary of establishment of the USSR constituted a vivid manifestation of this unity and support for party policy by all the people.

The armed defenders of the homeland see as their priority task that of standing vigilant and reliable guard over the peaceful, productive labor of the Soviet people, through selfless military labor strengthening the might of the multiethnic socialist state and serving as a mighty buiwark of peace and freedom throughout the world.

Together with the servicemen of the other branches of service and arms, the men of our glorious Air Force, understanding well the importance of the missions they have been assigned pertaining to ensuring the reliable security of the homeland, are devoting all their energies toward achieving new performance levels in combat and political training and in carrying out their constitutional duty to the people -- reliably to defend the socialist homeland, and to be in a continuous state of combat readiness guaranteeing an immediate rebuff to any aggressor.

The unprecedented upsurge in political enthusiasm in the military which has been noted in the new training year is a convincing expression of the high degree of consciousness and Communist moral fiber on the part of our air warriors, their deep understanding of the wise and perspicacious policy of the CPSU, and their boundless devotion to the great cause of Lenin.

Festively celebrating the 65th anniversary of the valiant Armed Forces, we turn our mind's eye again and again to their famed fighting history. Established by the Communist Party to defend the achievements of the Great October Revolution, they have trod a glorious, heroic road, have carried out with honor and dignity and continue to carry out their assigned lofty patriotic and internationalist mission.

The birth and fighting chronicle of the Soviet Army and Navy are inseparably linked with the name of V. I. Lenin. This ingenious commander of the proletarian revolution was the founder of teaching on defense of the socialist homeland, formulated the scientific principles of Soviet military organizational development, the foundations of our military doctrine and military science, and defined the tasks and historic mission of the Armed Forces of the Soviet nation.

Following the victory of the Great October Socialist Revolution, international imperialism, endeavoring to destroy the world's first worker and peasant state, organized an armed struggle against the Soviet Republic. The toilers were forced to join in a difficult, bloody war against the united forces of intervention and domestic counterrevolution. Establishment of a regular, cadre, rigidly disciplined army of the revolution involved enormous difficulties under these conditions. V. I. Lenin and the Communist Party, convinced that the revolutionary workers and peasants were determined to defend the cause of the Great October Revolution, gave them inspiration to accomplish this feat.

The flame of civil war and foreign military intervention raged in our country for a period of 3 years. The imperialist "crusade," supported by domestic counterrevolution, suffered a total defeat. The Red Army totally routed the armed forces of the White Guard and the interventionists. Socialism had won the first battle against imperialism. This victory was a triumph for the

great ideals of the socialist revolution and constituted evidence of the superiority of the forces of peace and progress over the forces of aggression and reaction.

Our enemies, however, refused to abandon hopes to undermine or destroy Soviet rule and refused to give up their insidious schemes to strangle the new system economically and militarily. In view of this fact, the Communist Party formulated a scientifically substantiated policy in the military domain for the entire period of building socialism and steadfastly implemented this policy. Strengthening of the defense capability of the Soviet Union was taking place in an inseparable link with successful accomplishment of the tasks of building socialism. Socialist industrialization, collectivization of agriculture, a cultural revolution, as well as just and fair resolution of the nationalities question dictated profound socioeconomic reforms in this country and transformed it into a mighty socialist state.

The Soviet Army and Navy were only 23 years old when fascist Germany, having enslaved almost all of Europe, perfidiously attacked the Soviet Union. International imperialism threw enormous fascist hordes, armed to the teeth, into the fray to defeat the world's first socialist state.

The Great Patriotic War was the most difficult of all the wars our homeland has had occasion to fight. The enemy's goal was to destroy the socialist system in the USSR; he planned to seize our land and wealth and to enslave the Soviet people. Responding to the call of the Leninist party, all Soviet citizens rose up as one into sacred battle for the honor, freedom and independence of their socialist homeland. Total love for the Soviet homeland, unswerving loyalty to the cause of communism, and determination to defeat the Hitlerite invaders no matter what the cost united the peoples of the multiethnic Soviet Union into a unified fighting family. The Leninist idea of defense of the achievements of socialism engendered heroism on the battle front and on the home front and was a source of the unprecedented patriotism of Soviet citizens.

Servicemen of the various nationalities and ethnic groups residing in the USSR bravely and selflessly defended their homeland, fought valiantly against the hated foe, displaying the greatest courage, valor, and self-sacrifice. And they emerged victorious, shattering the elite armies of the Hitlerite invaders and forcing them to surrender unconditionally and in disgrace. The heroic victories of the Soviet Army in the battles of Stalingrad and Kursk, in the Caucasus and on the Dnieper, the 40th anniversary of which is being celebrated this year, constituted a radical turning point in the course of the Great Patriotic War and sharply altered the military-strategic situation on the Soviet-German front.

Soviet military aviators also contributed a great many vivid pages to the combat chronicle of the Great Patriotic War. Having commenced the struggle for air supremacy in an exceptionally difficult combat situation, by the Battle of Moscow they succeeded in wresting the initiative away from the enemy, expanding this initiative in the skies over Stalingrad and the Kuban, while in the Battle of Kursk Soviet air forces gained air supremacy and held it firmly right up to the end of the war. More than 200,000 military aviators were awarded USSR medals and decorations for courage, bravery, heroism and military valor, and

2,420 of these were named Hero of the Soviet Union. A total of 65 pilots were twice awarded this title, while 2 aviators -- A. I. Pokryshkin and I. N. Kozhedub -- were awarded it three times.

In the course of the war 897 air combined units and units were awarded USSR decorations, 708 were given honorary designations, and 228 were given the guards appellation.

Our Leninist Communist Party was the inspirer and organizer of the victory of the Soviet Armed Forces over the shock forces of international imperialism. Transforming the country into a unified fighting camp and securing unity of political, economic, and military-strategic leadership, it was able to realize in a practical manner the potential and advantages of the socialist system. During the war years the CPSU became truly a fighting party, for it sent its finest forces into the Army and Navy. At the beginning of the war 1 out of every 9 servicemen at the front was a Communist, while by war's end the figure was 1 out of every 4.

The world-historic significance of the victory of the Soviet people and its Armed Forces in the Great Patriotic War lies in the fact that it exerted then and continues to exert today an enormous influence on the entire course of world development. This influence is clearly manifested in a steady growth of peace forces, strengthening of the might of world socialism, development of the class struggle of the international proletariat, increase in the mass character and influence of the Communist and worker movement, and strengthening of progressive trends in the anti-imperialist directional thrust in the development of liberated countries. The Soviet Armed Forces not only defended the freedom and independence of the homeland but also made a decisive contribution toward saving European and world civilization from destruction by the fascist barbarians.

After healing the wounds of war, in the postwar years the Soviet Union has made giant strides forward in all domains of socioeconomic and political affairs and today appears before the entire world as a nation of developed socialism, which is confidently advancing toward communism, as a bulwark of peace and the security of peoples.

Building communism and preserving world peace are two goals which have been and continue to be the highest and most indissoluble goals for the Soviet Union and the other socialist countries. However, while implementing the Leninist peace strategy embodied in the Peace Program for the 1980's formulated by the 26th CPSU Congress, the Soviet Union and the other nations of the socialist community realize that constructive tasks must be carried out in an extremely complex international situation.

Militant U.S. and NATO circles, hiding behind the insane myth of a "Soviet military threat," have adopted a course of policy aimed at thwarting détente and a return to the "cold war." They repeatedly appeal for a "crusade" against communism, the national liberation movement, and all progressive forces on earth.

The planned deployment of MX missiles on U.S. soil and intermediate-range missiles in Western Europe is an extremely dangerous escalation of the nuclear arms race.

The Pentagon has drawn up plans for the arms race extending over the next 5 years and up to 1990. In addition to the thousands of nuclear warheads already amassed, they plan to build many thousands of new ones, with even greater destructive force. Development of the most barbaric means of mass annihilation of human lives is in full swing, including chemical and neutron weapons. Even space is becoming an arena for Washington's militarist aspirations. All these military preparations pursue a single aim -- to destroy the existing military balance between the USSR and the United States, between the Warsaw Pact and NATO, to achieve military superiority over the socialist world.

All these things taken together, stressed USSR Minister of Defense MSU D. F. Ustinov in responses to questions put by a TASS correspondent, can scarcely be interpreted other than as a program of preparations for a nuclear world war.

It is appropriate today as never before to recall Lenin's wise and prophetic words: "A revolution is worth something only if it is capable of defending itself...." Our army inscribed these words on its combat banners. The truth of these words was convincingly demonstrated by the glorious victories of the Soviet Army. The enemies of peace have had occasion to learn time and again that socialism knows how to defend itself.

But we are well aware, it was noted at the special November (1982) CPSU Central Committee Plenum, that peace cannot be obtained from the imperialists by the mere asking. "It can be defended," CPSU Central Committee General Secretary Comrade Yu. V. Andropov stressed in his speech at the plenum, "only by relying on the invincible might of the Soviet Armed Forces."

Naturally the Soviet Union, faced by a growing military threat on the part of aggressive imperialist circles, is forced to strengthen its defense capability and maintain its Armed Forces in a continuous state of combat readiness.

Thanks to tireless concern on the part of the Communist Party and Soviet Government, the outstanding achievements of the socialist economy, and the remarkable successes of Soviet science and technology, the countenance of our Soviet Armed Forces has changed unrecognizably in recent years. Their organizational structure, technical equipment, and level of personnel combat and political training are fully in conformity with the increased demands. Today the Soviet Army and Navy have at their disposal everything needed to offer an immediate devastating rebuff to any aggressor.

The Air Force is vigilantly guarding our homeland's airspace. Today our Air Force is equipped with modern aircraft systems and has everything it needs in order worthily to carry out its sacred duty -- reliably to defend the socialist homeland and to be in a continuous state of combat readiness guaranteeing an immediate rebuff to any aggressor.

"The highest state of combat readiness of all Soviet Armed Forces branches of service and arms as well as the excellent level of combat proficiency and military skill of each and every serviceman," stated USSR Minister of Defense D. F. Ustinov, "constitute a guarantee of security of our homeland and reliable defense of all the nations of the socialist community."

Military aviators are persistently working to master modern aircraft systems and are learning, as is demanded by the USSR minister of defense, to take from their combat equipment and weapons the maximum of the capabilities they offer. The air proficiency of flight personnel is constantly improving, and the smooth fighting proficiency of air units and subunits is increasing. Air Force personnel are learning that which is essential in combat, in all weather, day and night, at airfields, on gunnery ranges, and in flight activities.

This past training year -- the year marking the 60th anniversary of establishment of the USSR -- was for military aviators an important stride forward toward further improving the combat readiness of units and subunits. Conducted exercises demonstrated the improved level of operational-tactical training of staffs and air proficiency of troops.

Firm discipline, organization and observance of regulations, the entire military life, grounded on strict observance of regulations, including those applying to flight operations, actively promote success in the campaign to achieve a high degree of combat readiness.

All-encompassing party-political work plays an enormous role in accomplishing the missions assigned to the Air Force. Following is a determining element in its content: indoctrination of Soviet military aviators in a spirit of selfless service to the homeland and dedication to the ideals of communism, and active mobilization of personnel to improve combat training effectiveness and quality, improvement in air proficiency and flight operations safety, excellent mastery of combat equipment and weapons, and strengthening of military discipline and organization.

The responsible missions being performed by the Air Force pertaining to ensuring our country's security demand that commanders, political agencies, party and Komsomol organizations constantly maintain their attention focus on improving effectiveness of training and indoctrination and achieving complete fulfillment of combat and political training plans and the requirements of orders issued by the USSR minister of defense.

Air Force personnel are celebrating this national holiday -- Soviet Army and Navy Day -- with new achievements in combat and political training, socialist competition, and further strengthening of military discipline. In the course of intensive winter combat training in conditions maximally approximating actual combat, pilots, navigators, engineers and technicians, junior aviation specialists, and support subunit personnel work tirelessly to improve air proficiency and professional skills, work hard to master their weapons and combat equipment, and acquire skilled mastery in the conduct of modern warfare.

Socialist competition under the slogan "Increased vigilance, reliably ensure the security of the homeland!" which is extensively conducted in the military constitutes a powerful means of indoctrinating servicemen and improving the effectiveness and quality of combat training. Excellent performance results in combat training and successful fulfillment of their socialist pledges were achieved by the competition initiators -- the men of the guards bomber regiment under the command of Gds Lt Col V. Tatarchenko. As is proper, other Air Force units and subunits emulate the competition right-flankers. They include the military units in which officers V. Vorob'yev, V. Verkhoglyad, A. Kolmykov, V. Murashkin, and others serve as commanders and political workers.

Unified with the people and ranked solidly behind the Leninist Communist Party, the Soviet Armed Forces are prepared at all times to carry out any order given by the homeland. They are now and will continue to be reliable defenders of the peaceful, productive labor of Soviet citizens and the great achievements of socialism and peace.

3024
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EXERCISE IN TACTICAL SUPPORT FOR TANKS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 4-5

[Article, published under the heading "For a High Degree of Combat Readiness," by military pilot and expert marksman Maj S. Vorotnikov: "In Coordination With Tanks"]

[Text] A system of training flight personnel has been established in our squadron, tested and proven through the years by practical results, a system which helps pilots assimilate theoretical knowledge faster and more thoroughly, helps them acquire the solid skills of combat employment of fighter-bombers, and helps them perform intelligently, resolutely, and with initiative in modern combat. In what does this system consist?

Subunit command personnel, taking into consideration the individual peculiarities of each aviator, prepare monthly and weekly combat training schedules which are realistically achievable, strictly in conformity with the requirements of guideline documents. These schedules specify a precise sequence in working on exercises, comprehensiveness in performing assigned tasks, and an intensive pace of studying theoretical material.

Of course such a work regimen demands of personnel maximum energy and effort, but the expended labor is fully repaid. I shall cite an example.

...As usual, the squadron began preparations in advance for the tactical air exercise. The operational area was known, and commanders took into consideration the fact that the pilots would be forced to operate in bad weather over unfamiliar terrain, in a rapidly changing situation. Concrete party-political work plans were specified at a meeting of the party bureau, at which they discussed where primary attention should be focused in order to mobilize the men for successful accomplishment of the impending mission. Flight leader military pilot 1st Class party member I. Pererva suggested that when working on precision formation flying, the flight formations be photographed from the ground. In his opinion this would graphically show each pilot in the four-aircraft flight any error he would make. This leading officer also recommended holding a discussion with the flight surgeon on the peculiarities of visual perception of the size of ground and air objects in relation to their degree of illumination. Party member Pererva mentioned the experience of one of the

pilots in his flight, who failed to hold formation due to ignorance of these finer points.

Other valuable suggestions were also made. They essentially boiled down to the following: to prepare in full measure to fight in a situation maximally approaching actual combat.

The aviators proceeded from word to deed. Aircraft operation drills were conducted in parallel with rehearsing missions in the air. At brief tactical exercises pilots worked on different maneuver variants, specified modes of teamwork and cooperation with ground subunits, and refined the procedure of response to commands by forward air controllers.

Following a suggestion by Maj B. Kozheurov, each pilot drew up an "I am in a hurry-I am late" table. the pilot would mark on the map alongside a reference point the precalculated difference between the scheduled and actual time over the reference point and correspondingly the speed which must be maintained in the following phase. These navigation calculations helped the group precisely maintain the schedule of fighter-bomber movement along the route and helped them reach their targets right on schedule.

We were little acquainted with the forthcoming area of operations, and limited time was allocated for preparation. Therefore each aviator endeavored to find the most efficient techniques of destroying the "aggressor" and suggested his own variants and intelligent innovations. Maj P. Shilovskiy, for example, together with Capt V. Shitikov and Sr Lt A. Kotko, drew on the flight line a large-scale map containing typical area and linear references. This helped the pilots study the area in detail and enabled them to run through the mission by the "walk through" method, taking terrain peculiarities into account. They also rehearsed actions to take upon receiving scenario instructions specifying change in the tactical situation.

Tactics. It is this science which determines the ways and means of achieving victory in today's combat. Tactics are continuously evolving and respond sensitively to changes in equipment, weapons, and means of control. Tactical skill, in combination with a high degree of professional proficiency and strong morale in aircrew personnel, is always embodied in actual strength which exerts decisive influence on the outcome of battle. Tactical training is inseparable from the degree of proficiency of flight personnel, and therefore the closest attention is devoted to tactics at every training exercise in this squadron. "Be an innovator and researcher, create combat" -- this is a principle which subunit personnel have following in preparing for exercises.

Engineers, technicians, and junior aviation specialists did a great deal of work during this period. Thoroughly readying the aircraft for flight operations, they also found time for continuous study, exchange of experience and know-how, and search for unutilized reserve potential.

We noted, for example, that certain pilots, even experienced ones, flying the same aircraft to the gunnery range, began receiving poor marks. What was the problem? Nobody doubted the skill of these air warriors. Engineer-aviation service specialists saved the day. They discovered alignment errors in the

fighter-bombers' aiming-navigation systems. The problem was immediately corrected. The specialists did not rest on their laurels, however. They formed three groups to check the accuracy characteristics of aiming equipment and weapons. A card was maintained on each aircraft, on which they entered bombing and gunnery results, objective inspection data, and with their assistance had the systems properly adjusted in short order.

The results of these efforts were soon in evidence -- the pilots began hitting targets with an average mark of 4.6.

Flight leaders bore particular responsibility during the period of preparation for the exercise. They passed the test with flying colors: they skillfully guided their men, innovatively analyzed the assigned missions and dynamically adjusted schedules taking into account specific conditions and the situation. Time was drawing closer, but the work rhythm was becoming more intense. It seemed that everything had been provided for and taken into account. But what if something had been omitted?

The signal to assemble put an end to all doubts. Personnel performed intelligently and with alacrity.

The defending force offered stubborn resistance. According to intelligence, they were intending to launch a missile strike on the reserves, to neutralize with artillery fire the main forces of the motorized riflemen and tankers which had penetrated the defense, and then to shift to a counterattack.

The commander, after analyzing the situation, decided to knock out the "aggressor" missile subunit. This was no easy job: the target was protected by powerful air defense weapons, which were well concealed and camouflaged. In addition, forecasters called for deteriorating weather.

Capt I. Pererva's flight took to the air. They maintained radio silence. Punching through clouds, the fighter-bombers took up an "aircraft vector" formation and set course for the first turn point en route. The aircraft sped above the cloud tops. Since the ground could not be seen, particularly precise flying was demanded of the flight leader. A slight error and, deviating from their course, the group would appear as a bright blip on the air defense radar screens.

They passed the first turn point. The instruments showed them right on course. The second turn point.... From this point on the "corridor" of invisibility to "hostile" radar came to an end. The flight, breaking through the overcast, descended to low level.

They swung left over the main reference point. The target should soon appear. How could they spot it, what maneuver should they execute? Captain Pererva was faced with a difficult task. But the time spent on ground preparations for the exercise had not been in vain.

...He turned onto the final attack course. A glance into the periscope indicated that his wingmen were in place. A strip of forest to the left, up ahead

a trapeziform field, beyond it the forest edge, and an unnamed stream to the right. The "aggressor" missile position was supposed to be somewhere beyond the woods, on a bend in the stream. That is what the scouts had reported. An adjustment turn to the right; the treetops seemed right off his wingtip.... Another adjustment turn.... There was the bend in the stream. At that moment the flight leader spotted the defending force missile subunit position. The launchers were ready to fire.

"Maneuver!" barked Captain Pererva's voice over the radio, his first command since the flight had taken off.

He and his wingmen swept toward the target.

"Angle! Sight mark on target! Speed!" the flight leader repeated to himself. "Release!"

Plumes from explosions rose skyward at the missile launcher site.

The second pair of aircraft, which had fallen back somewhat, screamed toward the radar site.

One more pass -- and the entire area was wreathed in smoke.

"Regroup!" came the flight leader's second command.

Within seconds the fighter-bombers had disappeared in the haze.

Stripped of missile support, the defending force was unable to hold back the advancing force and proceeded to fall back. The artillery also fell silent; it had been forced to change position.

The intensity of the exercise grew. Ground subunits were exploiting the successful advance with air support. Their tanks, having crushed the "aggressor's" resistance, had reached the river. They would have to cross it. At this moment reconnaissance reported that tanks had been spotted south of the crossing point -- the defending force's reserve.

Maj P. Shilovskiy's group was sent up to knock them out. Upon approaching the river, he made contact with the forward air controller: "'Oka', this is 525, entering your zone in 3 minutes."

"525, tanks two clicks south of crossing," the FAC replied.

The command took the pilots by surprise, but they were ready for such changes.

"Roger!" Shilovskiy affirmed.

The aircraft changed course. The river flashed under their wings.

"525, turn left!" the forward air controller instructed.

Executing a short climb, the fighter-bombers swung left and headed for the target.

The "aggressor" tanks were clearly visible. They were crossing a swampy stretch of terrain in column along a narrow dirt road and were unable to deploy laterally.

Major Shilovskiy and his wingman hit the lead vehicles. The rest of the group's pilots finished off the reserve force.

The crossing by the advancing main forces was no longer threatened and, upon successfully accomplishing the crossing, they advanced into the objective area.

All day the roar of afterburners thundered over the airfield. Fighter-bombers climbed skyward one after the other. In spite of the bad weather, the pilots were accurately reaching their targets and reliably providing air support to ground subunits.

Ground crews were working hard. They were doing an excellent job of turning the combat aircraft around and replenishing ordnance.

Political workers and Komsomol activists were doing a fine job. The results achieved by the top pilots immediately were communicated to all. During free moments pilots and technicians would gather by the information bulletins and photo displays, hotly discussing the course of socialist competition or laughing at the kindly, fun-poking cartoons.

A healthy spirit of competition, a sense of fellowship, and timely assistance to a lagging crew whenever needed enabled the subunit's aviators to accomplish all missions assigned by the command authorities. And the main reason for the men's success was planned and orderly, well thought-through preparation, continuous replenishment of theoretical and specialized knowledge and the endeavor to find and immediately adopt effective training methods in a practical manner.

Our commanders, political workers, party and Komsomol activists always remember the party's instructions on developing a work style which organically combines efficiency, discipline, bold initiative, and enterprise; a practical and businesslike approach with determination to achieve large goals.

Of course the combat and political training plan for a specified period of training has the force of law. And it must be observed unswervingly. But practical realities make their own adjustments, which must be considered. Prompt and timely changes in and adjustments to the combat training schedule, taking the concrete situation into account, and well-conceived combining of exercises by tasks enabled the pilots to maintain a high degree of proficiency, to avoid interruptions in complex flight training activities, and to learn effectively that which is essential in war.

The result is victory! It attests to the high air and combat proficiency of the squadron's pilots.

3024
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NEED FOR PROPER SPECIALIST TRAINING STATED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 6-7

[Article, published under the heading "For a High Degree of Combat Readiness," by Lt Col (Res) D. Rozhkov: "...But They Accomplished the Mission"]

[text] The modern aircraft is a crew-served weapon. A great many ground-crew specialists take part in readying it for a mission. Whether or not an air mission is accomplished depends to a significant degree on each of these personnel. But while there is a highly serious attitude toward training aircrews as the immediate executor of the commander's plan, sometimes insufficient demands are placed on the proficiency of support services specialists and instilling in them a strong sense of responsibility for the results of their labor. This applies first and foremost to training junior aviation specialists taking part in servicing aircraft and in flight operations support.

Some commanders believe that what in their opinion are the comparatively simple duties of mechanics, truck drivers, and personnel of other military occupational specialties do not require special attention, and they tend to ignore, to put it mildly, errors of omission and mistakes committed by subordinates. And yet such an attitude toward training specialists sometimes leads to a situation where complications may arise which threaten flight operations safety or which lead to failure to accomplish the mission, due to an oversight, carelessness, or other reason. I recall in this connection an instructive incident during the war.

It was 1943. Soviet forces, engaged in stubborn fighting, were advancing westward. Rail consists were being loaded with combat equipment and ammunition at a certain rail yard. Intelligence indicated that the Hitlerite command authorities had dispatched a large group of bombers to destroy this important target. Soviet pilots immediately scrambled to intercept. They were supposed to receive specific instructions on course, flight altitude and bomber intercept point by radio while in the air. But time passed, and the fighters received no instructions. The pilots began to be worried, for every minute counted.... What had happened? It seems that the command post was unable to contact the en-route aircraft due to a communications radio power failure. A mechanic, topping off the fuel tank to the radio power generator motor, had switched off power precisely at the moment when the fighters were approaching

the intercept area. It took a while to fire up the generator and tune the transmitter to frequency. It is true that the pilots did everything they could to spot the enemy. They intensified the circular sweep, spotted the group of fascist bombers, and attacked it. The enemy was unable to finish bombing the rail yard.

But if they had not succeeded? An important mission assigned by the command authorities would not have been accomplished. And everything because Pvt D. Mushtatov had violated important regulations specifying the procedure for working on combat equipment when on alert duty.

This incident, although it happened long ago, persuasively shows the potential consequences of failure to follow instructions, a lack of sharpness, and faulty actions by even a single individual. And while in the above example the outcome of the mission depended on several minutes, in present-day conditions we are dealing with seconds.

With the adoption of radio electronics, cybernetics, and electronic computers in the military, there has been a substantial change in the procedures of controlling combat actions by groups of aircraft in the air, coordination between pilots and tactical control officers, the form of giving commands, communicating orders and instructions. Today they are communicated not only to aircraft but also to ground specialist work stations both by radio and with the aid of various other signals. The aviator's work station has begun more and more resembling a unique laboratory. This is why extreme alertness and preparedness to comprehend a signal promptly and correctly and to respond to it with precision are demanded of each and every specialist. Otherwise there may not be enough time, for a second attack pass, for example. I shall cite an example.

On ground command, a fighter-interceptor had reached the intercept point and had begun active radar search for the "aggressor" target. The pilot was experienced, but no matter how hard he tried, he was unable to detect the target. A brief exchange was held between him and the tactical control officer, after which the interceptor had to return to base.

Post-mission analysis revealed that the mock combat mission had been thwarted through the fault of a radar operator. His attention diverted from the scope, he had failed to note the first target fix, and when he saw the second, it was too late. The "aggressor" proceeded to employ intensive jamming, and the target blip disappeared. Time was lost while the operator attempted to cope with the situation: the fast-moving target succeeded in evading pursuit. This was the result of inefficiency and irresponsibility by a specialist at the tactical control echelon.

Servicing and maintenance of modern aircraft systems is inconceivable without thorough knowledge of the equipment, continuous verification of procedures, and the ability not only to correct malfunctions promptly but also, by predicting failures, to prevent them in advance. Naturally without such qualities as self-discipline and efficiency, it is difficult to count on flawless performance of operations specified by service manuals in readying aircraft systems and equipment for flight operations. In addition, constant vigilance and self-monitoring can prevent the occurrence of preconditions for air mishaps.

...Flight operations were in progress. A fighter taxied up to the maintenance station by the runway. Jr Sgt N. Proshin, who was on duty there, was just completing inspection of the aircraft when his attention was drawn by a barely noticeable fuel stain on the underside of the wing. The mechanic took a closer look. He wiped off the stain with a clean rag, but soon a drop of liquid once again appeared at a point where the wing skin joined. The ground crewman immediately reported this fact to his superior. A thorough inspection revealed a fuel tank leak. Thanks to the vigilance and conscientious attitude of this ground crewman to performance of duties, a problem situation in the air was averted.

Discipline, efficiency, and verification -- these inseparably linked terms have special significance in aviation. As practical experience indicates, sometimes a single person determines the outcome of performance of a complex, critical air operation mission. Lack of alertness by a ground crewman can nullify the labor o a large collective, and in combat conditions can lead to serious consequences. Wherever aviators are taught, together with professional skills, and from the very commencement of service, a strong sense of responsibility for the assigned task, efficiency, and are taught to have affection for their equipment, as a rule violations do not occur. It is a matter of honor for each and every military aviator strictly to observe the provisions of documents regulating flight operations and to monitor one's every step and action in order to be absolutely sure that one has done everything in the proper manner. This contains a guarantee of flight operations safety and precise accomplishment of assigned missions.

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MOTIVATING PILOTS FOR TACTICAL FLIGHT TRAINING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 14-15

[Article, published under the heading "Party-Political Work Experience," by military pilot 1st class Maj I. Snegirev: "By Force of Word and Example"]

[Text] Each and every day of combat training, each and every flight operations shift enriches aviators with new knowledge and strengthens their skills. A special role in this is played by TFE [tactical flight exercises]. At tactical flight exercises air warriors are tested for professional and tactical proficiency and combat skill.

Our squadron was recently put to such a test. The unit commander gave general instructions on mission performance, gave a briefing on the climatic features of the objective area, and discussed the difficulties the pilots might encounter. We were to operate as an independent group, out of contact with our base.

Preparations began as follows: together with the squadron deputy commander for political affairs, military pilot 1st class Capt V. Smirnov, they checked the makeup of the aircrews and determined that each contained a fairly strong party group, capable of mobilizing the men to perform the assigned missions. Detachments, groups, and crews held party meetings, which helped the aviators become permeated with a feeling of responsibility for the forthcoming assignment. The subunit party organization secretary, military navigator 1st class Capt I. Klimenko, held a conference of party group organizers, crew agitators, detachment Komsomol organization secretaries, and Komsomol group organizers. They examined the place and role of each activist at the exercise and defined their work areas.

The preliminary period of work prior to the TFE came to a conclusion with an open party meeting of squadron personnel. At this meeting aviators who had taken part on numerous occasions in similar activities shared their experience at working at other airfields and told of the difficulties which flight and technical personnel might encounter. The audience listened with great interest, for example, to party members squadron engineer Engr-Maj B. Gavrilov, squadron navigator Maj A. Kulish, senior airborne technician Capt Tech Serv A. Prokhorenko, and other specialists.

The squadron party organization utilized diversified forms of methods of party-political work in order to enhance the Communists' leading role. Questions pertaining to exemplariness of CPSU members at the TFE were discussed at meetings and bureau sessions as well as in graphic agitation materials. High demandingness, intolerance toward shortcomings, and creation of a situation where not one instance of failure to carry out a party meeting decision or unconscientious attitude toward training is ignored constituted an indispensable means of mobilizing Communists for flawless performance of their party and professional duty. Checking progress in readying personnel for the TFE, for example, the squadron command authorities drew attention to the crew of military pilot 1st class Capt S. Chekhovskikh. The aviators pledged to perform all tasks with a mark of excellent. One did not sense a businesslike mood in the crew, however. Squadron party activists promptly came to their aid. They talked with the crew party group organizer and agitator, and demanded that they show greater initiative and aggressiveness. The crew commander also did a certain amount of work with individual crew members. Soon a healthy moral-psychological climate was established, and the aviators began working at full effort and assisting one another in all things.

The squadron party organization also concerned itself with improving efforts to indoctrinate Communists on advanced know-how, on the finest examples of performance of party and professional duty, and focused detachment and crew commanders toward improving the effectiveness of socialist competition. As a result, in preparing for the TFE competition was stepped up among detachments, crews, and groups, and competition results began to be totaled up more rigorously.

Competition progress was regularly presented in information bulletins, radio newspapers, and directly at the airfield. Leading performers were noted: the detachment of Maj V. Zanemonets, the crew of Capt M. Chufistov, the servicing and maintenance group of Capt O. Kravchenko, plus others. The aviators of these collectives displayed maximum organization, cool-headedness and smooth coordination in their work. Extensive publicity to competition and announcing of competition leaders boosted the spirit of competitiveness to an even greater degree and forced each individual to be more demanding in appraising the results of his labor.

The day of the tactical flight exercise finally arrived. They proceeded to the exercise location as a group. The entire course of preliminary preparation and its purposefulness strengthened the confidence of aircrews that they would successfully accomplish the assigned mission. Encountering bad weather, the crews performed with precision and smoothness.

In the staging area the command authorities thoroughly analyzed the performance of each crew and drew attention to deficiencies. After analyzing objective monitoring data, for example, it was determined that aircraft commander Capt I. Rozhok had sharply worked the elevator while on approach and had landed with an excessive G-load. The reason for this error was that the pilot was excessively tense. Concrete measures were specified on the spot. Maj V. Zanemonets, an excellent pilot and member of the squadron party bureau, gave advice to Captain Rozhok and drilled him in the aircraft cockpit. Pursuant to

the commander's decision, similar drills were conducted with the other pilots. Subsequent actions by the aviators at the TFE showed that the subunit command authorities and party bureau had made the right decision in conducting such a preventive effort: no more mistakes of this kind were made.

Party and Komsomol activists, led by the squadron deputy commander for political affairs, Capt V. Smirnov, handled publication of information bulletins updating news on socialist competition progress. They named competition leaders and related the experience of the leading performers. Volunteer propagandists party members K. Bondarenko, A. Moiseyenkov, A. Ovdiyenko, and others worked with initiative and innovativeness. In brief but effective discussions they communicated to each and every aviator the importance of the forthcoming assignment and helped command authorities organize training classes and exchange of advanced know-how. At the initiative of the activists, for example, there took place an exchange of experience and know-how between flight and technical personnel. Aviation-engineering service specialists party members O. Kravchenko, B. Maslakov, and their associates reminded the crew members of the most typical operational features of the aircraft's systems and equipment under various flight conditions. This get-together was definitely beneficial and helped improve flight operations safety.

...The order came: they were to land assault force supplies. In order to ensure secrecy of this maneuver, they decided to operate at night. They began loading the aircraft with the onset of darkness. Things were moving along briskly. Suddenly it was reported that cargo had been loaded onto one of the aircraft without instructions on placing the center of mass, which was making things difficult for the crew. Only minutes remained before departure. Party members V. Smirnov, O. Mosin, and N. Dzhaman, examining the necessary documents, figured weight and balance, and the crew had the aircraft airborne at the designated time.

We shall state frankly that in this situation party members performed as in combat, displaying initiative, determination, and skill. This gave squadron personnel increased energy and confidence, which had an immediate effect on the aviators' practical deeds. All crews accomplished the landing on high-mountain airfields surrounded by difficult terrain, with limited use of radar and in adverse weather, with excellent quality and required minimal time.

The squadron was given a mark of excellent for skilled, precision actions at the TFE. This is a result of harmonious, coordinated work by command authorities and party activists, who ensured personal exemplariness by all subunit Communists.

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PHYSICAL TRAINING, SPORTS IMPROVED PERSONNEL'S PERFORMANCE

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 22-23

[Article, published under the heading "For a High Degree of Combat Readiness," by Col I. Shtan'ko, Air Force chief of physical training and sports: "With an Eye to the Future"]

[Text] Alongside the major problems of our country's economic, sociopolitical and cultural affairs, the 26th CPSU Congress examined matters pertaining to further development of physical culture and sports, which found concrete expression in the CPSU Central Committee and USSR Council of Ministers decree entitled "On a Further Upsurge in Mass Participation in Physical Culture and Sports," issued in September 1981.

As a component part of Communist indoctrination, physical culture plays an important role in the lives of Soviet citizens and is a powerful means of strengthening their health, physical and mental energy. Therefore concern about development of mass sports participation among military personnel should be viewed as a task of national importance.

Analysis of the successes achieved by Air Force units and military educational institutions which have been winners in socialist competition attests to the fact that the level of physcial conditioning of personnel determines in large measure the quality of accomplishment of combat training tasks, and consequently also the level of combat readiness of crews and subunits. Physical training and sports activities conducted in the Air Force pursue precisely this goal. It has been proven by practical experience that a physically fit pilot with strength and endurance stands up more easily under various difficulties in flight, more rapidly reaches the summit of professional skill, has excellent coordination of movements, fast reactions, precise actions, and is more emotionally stable.

Good things are being said in a certain air-force garrison about Maj G. Kuzyashev, who is not only acknowledged to be the finest pilot in the unit but who has also won the title of regimental champion in officer multiple competition, and has met first-category performance standards in cross-country skiing, diving, parachute jumping, and military triathlon. There are many such officers in the Air Force. This is confirmed by the results of the "Shchit-82" [Shield-82]

exercise, which was a tough test of the combat proficiency of participating personnel, of their physical and psychological preparedness for operations in a situation maximally approaching actual combat. It is characteristic that serious attention is constantly devoted to aviator physical training in the air units which took part in the exercise. And this in turn greatly assists the men in successfully accomplishing combat training tasks.

In this connection we should like to stress that it is essential to instill in aviators a love of physical training and sports from their very first days at training school. Regular physical culture classes help enrolled personnel more confidently master their difficult profession and form skills by means of which they can assimilate elements of flight training more rapidly. It is appropriate at this point to recall the words of famed pilot and thrice Hero of the Soviet Union Col Gen Avn I. Kozhedub: "Morning workouts, when sometimes you wanted so badly to stay in bed rather than run over to a cold gymnasium, gradually developed in me not only speed and endurance but also persistence and stick-to-it-iveness. They toughened me and helped me withstand the heavy work loading."

Volition, character, staunchness and persistence in working toward an objective, developed in the process of sports activities, help enrolled personnel perform complex flight assignments. For example, Jr Sgt I. Grigor'yev and A. Kozhevako, and cadets I. Logvinenko, N. Koptelov, and S. Sadykov are well-rounded athletes who have on numerous occasions defended the school's honor in various competitions. They are also leaders in flight training.

Thanks to properly organized physical training of cadets and other enrolled personnel, the military collectives at the Kachinskoye Higher Military Pilot School, the Air Force Engineer Academy imeni N. Ye. Zhukovskiy, the Voronezh Higher Military Aviation Engineer School, and others have achieved excellent performances in athletics. The slogan "Every graduate a first-degree Military Sports Complex badgeholder and category-rated athlete" is being successfully implemented. These schools have repeatedly placed high in sports competitions among USSR Armed Forces higher educational institutions.

The modern combat aircraft systems with which the Air Force is equipped possess excellent performance characteristics. Only excellently trained and physically fit pilots are capable of fully utilizing their capabilities. This fact dictates the necessity of more purposeful planning and skilled organization of physical training and athletic activities in aviation units and military educational institutions. One should take into account more comprehensively thereby the specific features of flying labor in the various aviation arms. Although the goals and concrete tasks of physical training applicable to the specific features of flight activity in aircraft of various types are specified in the appropriate documents, nevertheless the search for ways to achieve a significant increase in the effectiveness of flight personnel physical and psychological training is one of today's complex tasks.

An important role is played by combined training activities, which help increase emotional stability, attention, improve motor coordination, and thus gradually prepare the system to withstand heavy stress loads. Many pilots and navigators, realizing the need for special training to improve professional

skills, not only themselves regularly engage in physical exercise but also enlist their subordinates as well. Capt V. Kutsovol, delegate to the 26th CPSU Congress, Gds Capt V. Bychkov and Sr Lt S. Glyanenko, delegates to the 19th Komsomol Congress, as well as Lt Cols S. Vasil'yev and A. Dzygalov, Lt V. Zhukovskiy and other officers have proven to be real experts at their job and skilled propagandists of physical culture and sports. Physical conditioning, to which they devote considerable attention, helps them achieve excellent performance figures in combat and political training.

Another and no less important task of physical training and sports in the Air Force is that of extending one's flying career, which is closely linked with health. As we know, work capacity declines as a result of insufficient physical activity, and various cardiovascular and nervous system ailments develop, which leads to premature grounding. But there are many examples where regular physical exercise extends active careers for years. Many Air Force command personnel who regularly take part in athletics pass their airman's medical examinations without restrictions at an advanced age and continue to fly modern fixed-wing and rotary-wing aircraft. They include Lt Gen Avn A. Tarakanov, Maj Gens Avn A. Tabunshchikov and Yu. Kulikov, Col V. Zhavoronkov, and many others.

Special exercises, which are performed during alert duty and extended flights, help increase resistance to the adverse effect of restricted motor activity, and help maintain working efficiency. These exercise sequences can produce the desired results only in combination with other forms of physical training. In addition, energy restorative exercises developed by physical training and sports experts help increase aircrew combat activeness. They can be successfully utilized alongside special physical training classes and mastery of applied skills and techniques of accident survival.

Physical training and sports are also essential to engineer and technician personnel. Many units and military educational institutions allocate time for sports. For example, in the technical maintenance unit headed by Engr-Maj A. Zhuravlev, personnel physical training is fully in conformity with the requirements of guideline documents. And it is not surprising that teams representing the subunit have repeatedly placed high in many competitions. For five years now the technical maintenance unit has been the best one in the combined unit. Officer Zhuravlev himself is first category in soccer and basketball and skillfully combines sports activities with successful performance of his military duty.

The level of physical training and sports activities depends on many factors, including the state of athletic facilities. The Air Force has amassed a wealth of experience in building gymnasiums and sports centers, stadiums and special facilities. Their countenance has changed qualitatively at many garrisons. Much work in this area has been done by sports committee members Lt Cols N. Nelin, R. Mustafin, A. Nadelyayev, and others. Notable about many Air Force units and military educational institutions is the fact that Communists and Komsomol members have begun working in closer contact with physical training and sports specialists.

Unfortunately, in spite of certain achievements in organization of physical training, in some Air Force units and military educational institutions this work is still being conducted inadequately purposefully and persistently. In addition, some commanding officers frequently reduce the time allocated for morning calisthenics, fail to eliminate instances of canceling scheduled classes, and do not fully implement measures pertaining to development of mass sports activities in the interests of improving flying proficiency and forming in aviators excellent fighting and moral-political qualities. Elements of excessive attention to form with consequent detriment to content, indifference and irresponsibility have not been rooted out. Only this can explain the poor level of physical training and sports activities in the unit in which officer N. Mitrofanov serves. Sports committee members Lt Cols V. Koval' and K. Zinov'yev are working far below their capabilities. The men of these units produced poor results at the final test at year's end.

In some units and military educational institutions available athletic training facilities have become obsolete and are in a neglected state. This situation makes it impossible to conduct classes according to training schedules with a high degree of effectiveness. Sometimes gymnasiums are not utilized for their designated purpose.

Aviator physical training is relegated to a secondary role in the air forces of the Transcaucasus Military District and the Baltic Military District. But the sports committees in these districts are failing to take concrete measures to improve it. Apparently certain commanders and political workers are not yet fully aware of the importance of personnel physical conditioning for improving combat readiness. Unfortunately, they sometimes harbor the view that flight activities involving heavy physical stresses are equivalent to athletic workouts. These are quite disparate activities.

It is no secret that diminished demandingness on organization and conduct of physical training and replacement of a planned and orderly training process with haphazard workout sessions lead to a situation where military personnel rapidly lose the requisite skills. Also causing concern are poor results in the physical training level of the graduates of certain schools. Apparently the quality of their conditioning has been negatively affected by eliminating state examinations in physical training from the schedule at military educational institutions.

Constant attention toward physical culture and sports and good organization of classes, workouts and competitions make it possible to train in the military a large number of Military Sports Complex badgeholders and category-rated athletes. A positive role in this is played by physical training reviews and mass sports activities. A certain system has formed in the course of these activities, which is continuously being improved and in the majority of units is in conformity with the tasks of personnel combat training and activities. Certain commanders, however, at times follow the line of least resistance: they boil down all mass sports activities to the holding of reviews and, based on the results of these reviews, evaluate the status of the entire organization of physical training in the subunits and units. Such an approach to organization of physical training and mass sports activities frequently leads to a situation where personnel train for competitions in a sporadic manner. In other words,

what happens is the usual dragging of review participants up to a specific result. It is premature to reach a final conclusion, but in our opinion unsatisfactory organization of physical training in certain units has resulted in sports activity reviews failing to produce the desired results. And yet the principal form of physical training is regular scheduled practical classes, which should be conducted on all sections of the Air Force program. Only at these classes do personnel obtain a specific base of diversified preparation.

It is quite understandable that successful accomplishment of military personnel physical training tasks depends on correct selection and placement of cadres at Air Force schools. Nevertheless some departments and curricular areas at air-force schools are staffed by specialists who, although having a specialized higher education, have not had the experience of serving in line military units. As a rule they possess inadequate mastery of command skills and are poorly acquainted with the applied military exercises in the training program of line units. Therefore it is difficult for them to accomplish training and indoctrination tasks in full measure and to form the requisite physical and volitional qualities in officer candidates and other enrolled personnel.

Successful accomplishment of tasks pertaining to increasing mass participation in physical culture advanced at the 26th CPSU Congress depends in large measure on planning of sports activities and guidance of the physical culture movement in the Air Force. There is now an acute need to work out a system of holding various competitions taking into account the specific features of the tasks performed by personnel. Qualitative planning (competition timetables, type of sports, number of participants, etc) will unquestionably make easier the job of specialists in physical training and sports and will make it possible to condition personnel in a more purposeful manner.

At the same time there are problems resolution of which depends not only on the attitude toward physical conditioning of military personnel directly in Air Force units and schools. As we know, the foundation of physical training of the younger generation is laid down at the general-curriculum schools. There still occur cases, however, where young men entering the military, GTO [Prepared for Labor and Defense] badgeholders and category-rated athletes fail fully to meet athletic performance standards. A certain percentage of young men enrolling in Air Force schools receive low marks in the physical training entrance exams, and yet the combat readiness of the Air Force depends not only on comprehensive conditioning of those who guard our nation's sacred borders but also on the level of preparedness of the young men who will replace them, who will be taking their place on the line.

An important task of commanders and political workers of Air Force units involves continuously improving the system of physical training of aviators, establishing and strengthening sports facilities, planning sports activities with precision and unswervingly carrying them out. This will make it possible to achieve strong physical conditioning on the part of personnel and mass sports participation in the Air Force.

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HELICOPTER GROUND EFFECT DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 26-27

[Article, published under the heading "Constant Attention to Flight Safety," by Engr-Col A. Volodko, doctor of technical sciences, USSR State Prize recipient: "On a Cushion of Air"]

[Text] The overloaded helicopter lifted heavily off the concrete surface and hovered several meters above it. While the engines strained at takeoff power, the crew was making final assessments of the capability to take off in the helicopter manner. There was just barely such a possibility, and the helicopter proceeded to accelerate along the runway, slowly gaining altitude.

Of course it would have been better to take off like a fixed-wing aircraft, with a conventional takeoff roll. But in this instance another consideration seemed important. The mission called for dropping supplies from hovering mode into a tactical target area, with subsequent flight to another airfield. The load was rather heavy, and it was necessary practically to top the fuel tanks off, and therefore it was necessary to determine the helicopter's capability to hover in ground effect.

After a 20-minute flight the crew reached the designated en-route point and passed over the drop site. Strange as it seemed, it was deserted, while the people waiting for the supplies were joyfully waving their arms from another site, located approximately 100 meters from the first. The second site was on a small hill sparsely covered with brush. There were clear approaches to the hill, and alongside it ran a dirt road, on which a truck was standing. The people below probably thought that this was a better site for the drop than the one designated in the operation order.

The helicopter pilot was of a different opinion, but he shared it only with his crew. He did not want to have to report the situation to the command post and return without accomplishing the mission.

Making one more circle, the helicopter proceeded to make its approach to drop the cargo onto the hill, smoothly losing speed, but rapidly losing altitude as well. They had now reached the hovering check altitude, which should have been greater than on takeoff because of burning off part of the fuel. But the

helicopter continued to descend. What was to be done? Collective was almost all the way up, but there was no more altitude margin remaining to abort for a second go-around straight ahead or with a left turnout.

The helicopter hit the slope, damaged its landing gear, and by some miracle managed not to strike the ground with its rotating blade tips. When the rotor finally slowed to a stop, the people on the ground, running up, were treated to the sight of the embarrassed crew members rubbing the bruises they had sustained.

What had happened? Why had the ground effect, which had properly operated during the helicopter's takeoff, failed here? In order to answer this far from simple question, let us examine in more detail the physical substance and quantitative mechanisms involved in the formation of ground effect. We shall analyze the factors on which this phenomenon depends.

When a helicopter hovers close to the ground, induced flow from the main rotor, approaching the ground surface, slows and spreads out along the ground surface. Velocity v of the rotor blade induced flow, which is 15-20 m/s in hovering mode, diminishes to zero as it approaches the ground.

The hydrodynamic effect of the ground's influence on main rotor characteristics consists in the fact that with total deceleration of the velocity head of the induced flow $\frac{\rho v^2}{2}$ on the blocking ground surface, atmospheric air pressure p_0 increases to $p_0+\frac{\rho v^2}{2}$, and a so-called ground effect is created under the main rotor, that is, a region of higher pressure. It is for this reason that we usually say that close to the ground a helicopter hovers (travels) na vozdushnoy podushke [on an air cushion -- in ground effect].

If thrust is maintained constant as a helicopter approaches the ground, the required induced power and correspondingly the full power required to produce a given main rotor thrust decreases due to a decrease in induced velocity. When power applied to the main rotor is maintained constant, thrust increases for the same reason. This effect of the ground on the aerodynamic characteristics of a main rotor is manifested to the greatest degree when hovering, while it rapidly diminishes with an increase in the helicopter's translational speed (or surface wind velocity while hovering).

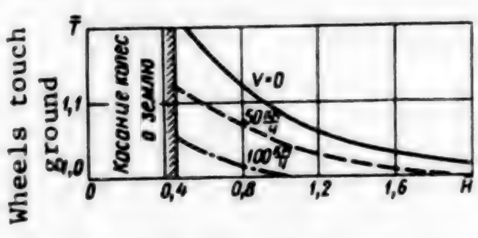

Figure 1. Relationship Between Main Rotor Relative Thrust, Height Above Ground, and Translational Speed of Mi-8 Helicopter

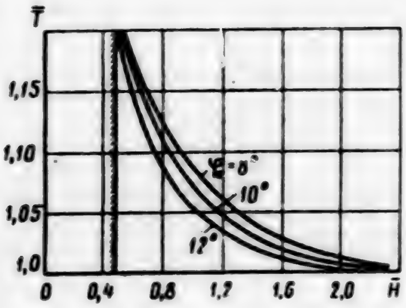

Figure 2. Influence of Main Rotor Collective Pitch Angle on Thrust Increase Close to the Ground

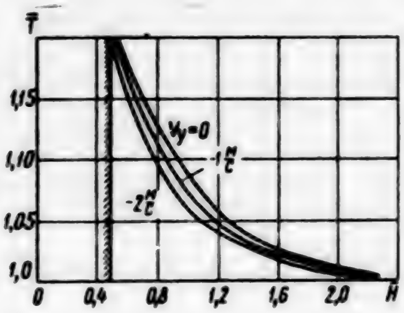

Figure 3. Influence of Helicopter Vertical Landing Speed on Main Rotor Thrust Increase Close to the Ground

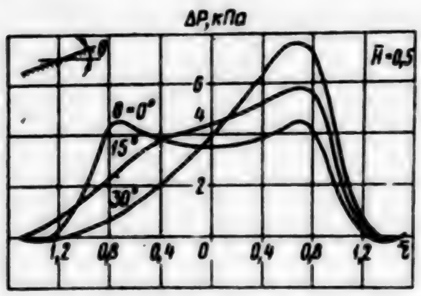

Figure 4. Distribution of Air Pressure on a Sloped Site

These points are illustrated in Figure 1, where values of thrust T are correlated to a corresponding value in an unbounded air space, while heights above ground H, as in all other figures, are correlated to the radius of the main rotor. When a helicopter is hovering, for example, at a height of $\bar{H}$=1 from the main rotor tip-path plane to the ground, thrust at constant power increases by approximately 8 percent, which is quite substantial. In fact, the load-carrying capacity of an Mi-8 helicopter can be increased by almost 900 kilograms under these conditions, while that of an Mi-6 helicopter can be increased by 3000 kg. Therefore the positive effect of ground proximity is utilized in practical flight operations to increase a helicopter's load capacity, especially in summer, when engine maximum takeoff power decreases. It is evident from Figure 1 that the effect of ground proximity practically disappears when $\bar{H} \geq 2$ ($H \geq 2R'$) and $V \geq 50$ km/h.

The greater the barometric altitude of the site above which a helicopter is hovering, the smaller the ground effect, because the air is thinner. For an Mi-8 helicopter, for every 500 meters of site elevation, the ground effect diminishes by approximately 1 meter. For example, when a helicopter is hovering over a site at sea level, the 10 percent increase in rotor thrust due to ground effect corresponds to the distance from the rotor tip-path plane to the surface of the ground $\bar{H}$=0.85 (H=9 m). But when hovering at an altitude of 2000 meters above sea level, the same rotor thrust increase is achieved when H=5 m, when the helicopter's wheels are practically touching the ground.

Ground effect also depends on the helicopter's flying weight and hovering mode. The heavier the helicopter and correspondingly the greater the collective pitch angle required to hover, the greater the overpressure in the air cushion, but at the same time the greater the relative losses of this pressure. As a result the relative thrust increase diminishes (Figure 2).

In this instance the mode of helicopter hovering is defined as its rate of approach to the ground when landing in the helicopter manner. The fact is that the above-discussed quantitative mechanisms of ground effect are valid only in a static situation, that is, with an infinitely small helicopter vertical descent rate prior to landing. It decreases appreciably in the dynamics of landing (Figure 3). Therefore when making a rough landing with high vertical velocity V_y, one should not count fully on the damping action of ground effect.

A slope to the ground surface in relation to the rotor tip-path plane produces considerable asymmetry in pressure distribution on the ground surface (Figure 4). A lateral hydrodynamic force comes into play, which acts on objects positioned in the rotor slipstream, including the helicopter fuselage. When hovering above a slope the angle of which does not exceed approximately 45°, the lateral ground effect component drives the helicopter from the slope (Figure 5), and to compensate for this effect the pilot must tilt the helicopter toward the slope, which naturally complicates hovering conditions.

When a helicopter is hovering over a hilltop, the rotor blade induced flow flows down the slopes and generates less ground effect. The steeper the slopes and the smaller the hill, the smaller the ground effect (Figure 6). If the hill slopes exceed approximately 45°, ground effect is practically zero.

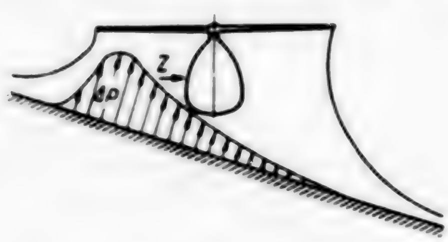

Figure 5. Diagram of Aerodynamic Effect of a Slope on a Hovering Helicopter

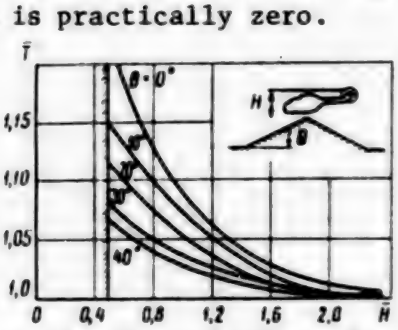

Figure 6. Ground Effect During Helicopter Hover Above Hill

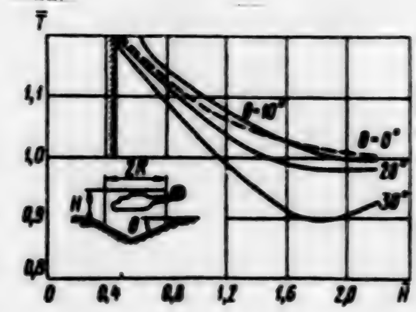

Figure 7. Ground Effect During Helicopter Hover Above Conical Pit

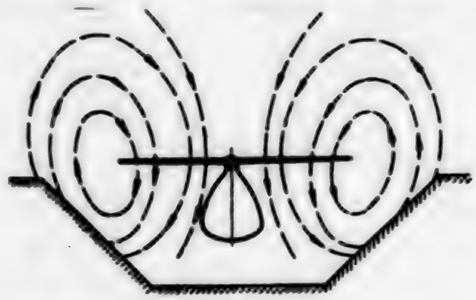

Figure 8. Diagram of Formation of Circular Vortices When Helicopter Hovers Above Deep Conical Pit

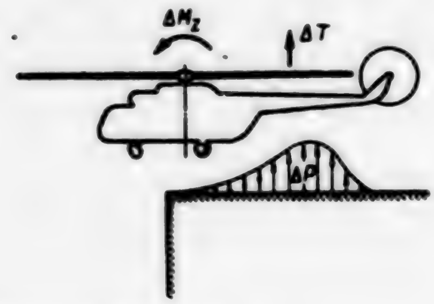

Figure 9. Diagram of "Corner Effect"

When a helicopter hovers above the center of a conical pit, ground effect depends on the slope of the pit walls at the given hovering height, which in the given instance is measured from a plane parallel to the base of the pit and cutting it along a circumference with radius R (Figure 7). If the pit is shallow ($\theta < 10°$), ground effect increases due to the fact that the pit walls hold the air cushion better and make it somewhat denser. When the pit is deep ($\theta > 20°$), the pit walls form a vortex flow with part of the induced flow thrown back onto the main rotor (Figure 8). This causes a ground effect reduction analogous in principle to a decrease in rotor thrust in vortex ring mode. When hovering at a height of approximately H=2R from the bottom of a deep, steep pit (θ=30-40°), rotor thrust is even less than without ground effect, and therefore there occurs a dangerous tendency for the helicopter to be sucked into the pit.

A cylindrical pit with vertical walls has even greater effect on rotor characteristics. When the diameter of such a pit is equal to 2-2.5 rotor diameters, while

the height of the walls and helicopter hovering height above the edge of the pit is approximately equal to the rotor radius, a powerful vortex torus is formed in the pit, and rotor thrust may decrease by 20-30 percent below free thrust, which is highly dangerous. If the diameter of the pit does not exceed the diameter of the rotor, a fairly stable and calm air cushion is formed in the pit, which on the whole has a positive effect on rotor characteristics.

Thus the influence of slopes and configuration of the ground surface (topography) is rather complex, and for the most part adverse. Therefore in flight operations one should avoid hovering and approaching at extremely low heights above very rough terrain.

As a consequence of the peculiarities noted above, it is also essential to avoid helicopter hovering and translational movement in the vicinity of a corner screen (the flat roof of a building, the edge of a ship's deck): ground effect disappears under part of the swept rotor disk, and the helicopter tips sharply "over the abyss" (Figure 9).

Landing site vegetation and soil also influence ground effect. For example, a grass cover, due to the fact that it decelerates air, increases overpressure in the air cushion and has an overall positive effect. Rotor thrust increase is approximately the same as when decreasing hovering height by the height of the grass cover.

Comparatively high brush partially disrupts the ground effect as a consequence of additional vortex formation and nonsmooth air flow. Essentially the same thing is observed when a helicopter hovers above treetops.

Vortex air currents are generated above a small natural forest clearing, similar to those described in the case of a deep pit. Therefore ground effect diminishes, especially if the diameter of the clearing is 1.5-2 rotor diameters, and the brush or treetops ringing the clearing are thick.

We shall note in conclusion that the influence of a screening surface on the aerodynamic characteristics of a rotor blade depends in turn on the influence of many factors, which are difficult correctly to assess and predict. In order to eliminate the possibility of a spontaneous change in rotor thrust caused by topography and vegetation, which can make it difficult to fly the helicopter and may cause it to crash, helicopters should fly at a height of not less than 15 meters above normally broken terrain and not less than 20 meters above highly broken terrain at speeds of not less than 50-60 km/h. It is not recommended that crews of embarked helicopters intersect the ship's deck and approach superstructures at a height of substantial ground effect.

And finally, it is important to bear in mind that ground effect is generated only above a flat, hard surface, greatly diminishing or even practically disappearing under the effect of the factors discussed above. This will make it possible to avoid errors similar to that which damaged the helicopter during an unsuccessful attempt by its crew to hover over an unsuitable site.

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ERRORS IN LANDINGS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 30-31

[Article, published under the heading "The Reader Ponders," by military pilot-instructor 1st class Maj N. Litvinchuk: "What Was the Error?"]

[Text] The trainer was approaching the runway. The pilot was precisely maintaining glide angle and course. The parameters, as they say, were optimal. It seemed that the landing would be brilliant. But the aircraft flared too high.

The pilot's training manual discusses in detail how to correct such an error. In this instance, however, the student pilot responded poorly. Instead of holding the stick firm and pulling it back when the aircraft reached the correct height above the runway, thus giving the aircraft the required nose-high attitude for landing, he pushed forward on the stick. The aircraft dropped quite steeply and, its nose dropping, rushed groundward. Trying to correct the situation, he vigorously pulled back on the stick but... it was too late. The aircraft was damaged as a result of the rough landing. The reason for this was clear: pilot error. But how should it be classified? Here the experts' opinions differed.

Here we are assisted by objective monitoring means (SOK), which play an important role in flight safety. Utilizing their recorded data, one can completely reproduce a flight and determine the actual parameters and how they differ from the prescribed parameters. SOK information, however, is at the present time being insufficiently utilized to determine pilot errors, although statistics indicate that many preconditions for an air mishap have occurred chiefly due to crew errors. Utilization of SOK, especially on-board devices, following the suggested method, can have a positive influence on flight safety.

Pilot error is usually defined as a discrepancy between a pilot's actual actions and the prescribed actions. Flying an aircraft in turn contains three sequential stages: receiving information (distribution and switching of attention); information processing and decision-making; work motions to execute the decision. Due to the time factor, flying an aircraft with the required precision is possible only with good skills and ability, in which sensorimotor skills play a significant role.

Pilot error can begin at any stage and in the final analysis will lead to incorrect displacement of the controls, and consequently to deviations in flight

parameters. Control movements, however, differ from one another in relation to the stage at which the error begins, even if they lead to the same deviation. Figures 2-4 show SARPP-12G recorded data on a landing by an L-39 trainer, rough landings due to mistakes by the student pilot. A record of a correct, standard landing is shown in Figure 1 for the purpose of comparison.

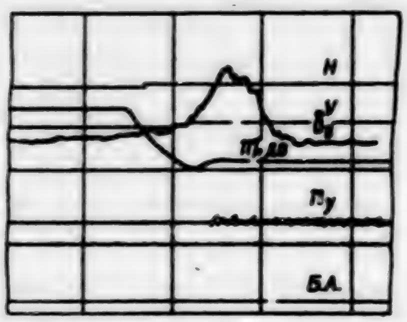

Figure 1. Record of Nominal Landing

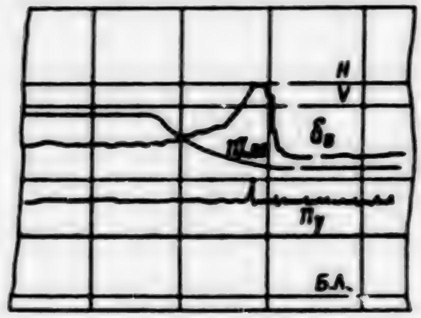

Figure 2. Rough Landing Due to Pilot Error in Receiving Information

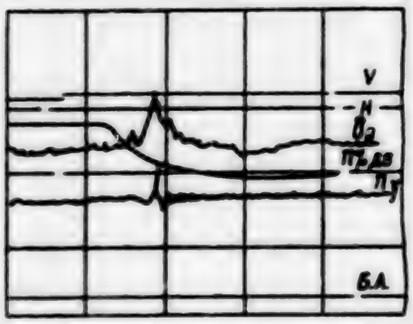

Figure 3. Rough Landing Due to Error in Decision-Making

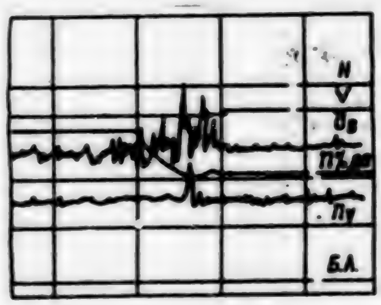

Figure 4. Rough Landing Due to Error in Control Movements

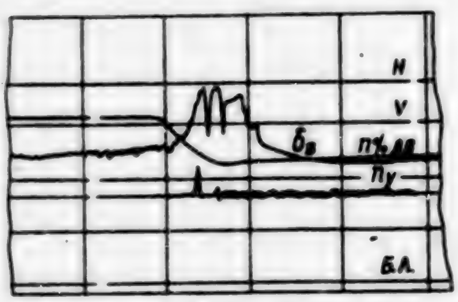

Figure 5. Rough Landing and Repeated Aircraft Separation From Runway Contact

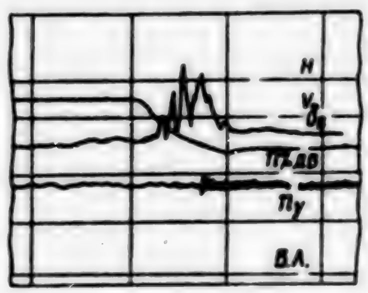

Figure 6. Multiple Flaring

It is evident in Figure 2 that movement of the control stick conforms to the standard. The pilot did not endeavor to prevent a rough landing by additionally pulling back on the stick. This indicates that he failed to note the increased rate of descent. Such errors occur in the information receiving phase. They

can be caused by lack or partial loss of the skill of distributing and switching attention, poor information receiving due to inattention or lack of composure.

The situation in Figure 3 is different. The pilot noted the high flare and corrected it by vigorously pushing forward on the stick. According to the manual, he should have held the control stick where it was, allowed the aircraft to descend, and then executed a normal touchdown. It is further evident from this record that under the circumstances subsequent pulling back on the controls could not avert a rough landing.

Errors of this type pertain to the information processing and decision-making phase. They can be caused by insufficient knowledge (poor preparation for the training flight), intellectual skills and abilities required for promptly making the correct decision, a person's limited capabilities to process information, lack of discipline, etc. It is evident in Figure 4 that the pilot's actions on the controls during execution of a landing differ greatly from the standard in both amplitude and frequency. One can assume that this disproportion led to a rough landing. The certainty of such an assumption will be greater if it is determined that the pilot saw the deviations, knew how to correct them, but was unable to do so. In this instance the error pertains to the phase of his control movements, and it may be caused by insufficiently mastered motor skills, their partial or total loss, as well as a deliberately introduced deviation.

The above examples have been taken in "pure" form, when an error arises only at one phase and is not linked to others. In actual practice, however, errors can occur at two or three phases and be interlinked. Control movements will be of a complex type, which makes it difficult to determine the phases of error occurrence.

Figures 5 and 6 show typical errors in sensorimotor activity connected with looking in the wrong direction while landing. In this case, while landing the aircraft, the pilot was looking forward through the windshield. Errors in height perception during a rapid change in pitch angle and an abrupt movement of the controls led in the first instance to a rough landing, with subsequent bouncing of the aircraft off the runway, and in the latter case to multiple flaring. In order to simplify analysis, in these cases it is advisable to have a set of standard recordings of those deviations which are the most dangerous from the standpoint of flight safety, with different error variations.

Pilot errors, even leading to the same deviations, can be quite different. Incorrect determination of the nature of these errors can lead to erroneous measures to prevent them. Containing objective information, SOK records make it possible to avoid this to a certain degree.

On analogy with deviations and pilot errors occurring during landing, they can be examined at all phases of a flight. Information reliability increases sharply if a pilot repeatedly makes the same errors and the conclusions based on the SOK records coincide.

Before proceeding with an analysis of the control movement records, it is necessary to make sure that a deviation was a consequence precisely of a pilot error.

Isolation of pilot error with the aid of SOK from other factors is accomplished in two stages. At the first stage -- by obvious indications. For example, if it is evident from the record that the deviation begins before the corrective effort, and it cannot be explained as the result of preceding actions, one can assume that it was caused by other factors. In this case it is necessary first of all to examine the capabilities of the entire "pilot-aircraft-environment" system to correct a disturbance.

At the second stage we analyze cases where deviations are caused by movement of the controls but where the role of other factors in this is not clear. In addition to airborne SOK, ground SOK are also used, as well as subjective observation.

Naturally SOK data not only do not exclude but also presuppose other types of monitoring, including subjective.

The principal advantage of this trend in utilization of SOK is the fact that additional devices are not required. It is based on analysis of the qualitative aspect of their records, and the principal information is provided by recording of deviation in parameter and movement of controls. Such an analysis can be performed immediately following a flight.

Airborne objective monitoring systems make it possible to analyze chiefly errors connected with longitudinal movement of the control stick and with deviations in parameters, recording of which is performed continuously. The rate of recorded changes is commensurate with the rate of displacement of controls (n_y, n_x, n $\%_{mo}$). In order to expand the capabilities of SOK, it is advisable to have data on control stick lateral displacement, pedal deflection, a record of force applied to controls, bank, pitch, and course angle, as well as to improve resolution and accuracy of recording of other parameters.

Analysis of pilot errors from flight recorders requires certain skills in deciphering the data, as well as knowledge of psychology, education science, and the specific features of flying. Methods of determining pilot errors from flight recorder data have not yet been fully worked out. A new trend in using SOK (utilization of objective information for analyzing deviations according to the scheme: deviation → pilot error → its cause) will make it possible more accurately and, most important, more efficiently to analyze a pilot's actions in the various phases of a flight. Experience indicates that with correct employment of cause-and-effect relations, using the records even of conventional SARPP airborne SOK, one can also objectively judge the cause of a pilot error. Competent utilization of the additional capabilities of SOK will make it possible to improve the quality of aircrew flight training and will improve flight safety.

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NINTH ALL-UNION DOSAAF CONGRESS REPORTED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 32-33

[Article, published under the heading "Ninth All-Union DOSAAF Congress," by Hero of the Soviet Union Col Gen Avn S. Kharlamov, deputy chairman of the Central Committee of USSR DOSAAF: "Reliable Reserve"]

[Text] The activities of the Voluntary Society for Assistance to the Army, Air Force, and Navy are extensive and diversified. They are directed toward training technically competent specialists and physically-fit patriots with strong moral fiber.

Hero of the Soviet Union Col Gen Avn S. Kharlamov, deputy chairman of the USSR DOSAAF Central Committee, tells about flight training of DOSAAF aviators and the sports achievements with which they are honoring their Ninth Congress.

The Voluntary Society for Assistance to the Army, Air Force and Navy is an active assistant to the Communist Party in strengthening this country's defense capability, in military-patriotic indoctrination of working people and youth, and a reliable army and navy reserve. Today it has reached an important landmark. Everywhere party guidance of the activities of DOSAAF organizations has become strengthened, and greater attention is being paid to these organizations by soviet and economic agencies, the Ministry of Defense, and the Main Political Directorate of the Soviet Army and Navy; they have strengthened meaningful relations with Komsomol, the Soviet trade unions, the unions of creative artists, the press, radio, and television.

Our committees are successfully accomplishing the tasks assigned to the Defense Society, tasks of military-patriotic indoctrination of working people, preparing young people for service in the army and navy, dissemination of military technical knowledge, and development of the applied military sports -- all that which helps increase the fighting efficiency of the Armed Forces.

The behests of Lenin, the provisions of the USSR Constitution, and the demands of the CPSU pertaining to defense of the socialist homeland were widely publicized during the period of preparations for the 60th anniversary of

establishment of the USSR and the 9th All-Union DOSAAF Congress. Reports and elections in our party organizations have fostered further comprehensive improvement in the work done by DOSAAF organizations in light of the decisions of the 26th CPSU Congress, CPSU Central Committee plenums, and the decrees entitled "On Improving Ideological and Political Indoctrination Work" and "On Further Boosting Mass Participation in Physical Culture and Sports."

DOSAAF aviators are advancing toward their congress with excellent performance results in socialist competition. They are applying maximum effort in order to help in every way strengthen the homeland's defense might and to defend its athletic honor in a worthy manner in the international arena.

The Voluntary Society has started out toward a flying career many boys who subsequently became military pilots. During the years of the Great Patriotic War almost 60,000 airplane and glider pilots went into the military from flying clubs. One Hero of the Soviet Union out of every three is a product of the Defense Society. About half of the aviators who are twice Hero of the Soviet Union came from DOSAAF.

Today as well DOSAAF is making a major contribution toward strengthening the might of the Soviet Army and its glorious Air Force. We receive from commanders and political workers of units and subunits flattering comments about graduates of our schools and flying clubs. Many of them receive commendations and government decorations for exemplary performance of their duties, for courage and valor. For example, the following flying club products have been awarded USSR medals and decorations for excellent combat and political training and for flawless performance of duty: N. Cheshek from the Minsk Flying Club, V. Vendrov from the Mogilev Flying Club, V. Grishin from the Dnepropetrovsk Flying Club, and A. Starushko from the Donetsk Flying Club.

In the course of the "Zapad-81" [West-81] military exercise, the Order of the Red Star was awarded to Kiev Flying Club graduate Pfc L. Manokha and Sverdlovsk Aviations Sports Club graduate Jr Sgt A. Uporov. During an airborne assault these men found themselves in an exceptionally hazardous air situation. The suspension lines on Aleksey Uporov's parachute had tangled. Leonid Manokha came to his friend's aid. He grabbed the junior sergeant's tangled canopy. Landing under a single canopy, they continued performing their mock combat mission together with all the rest of the men of the subunit. Pilot 1st Class Gds Maj V. Solov'yev, who had received training at the Chelyabinsk DOSAAF Flying Club, was awarded the "For Service to the Homeland in the USSR Armed Forces" decoration, 3rd Class, for successful accomplishment of a difficult mission at that same exercise.

DOSAAF product Lt Col V. Shcherbakov, commander of a helicopter squadron, who has been awarded the title Hero of the Soviet Union, has displayed time and again a high degree of expertise and psychological firmness.

Svetlana Savitskaya was a 17-year-old college student when she joined the Third Moscow Flying Club. Some time later she had logged 500 parachute jumps and was the holder of three world records in high-altitude group jumps. Later she became world champion in precision flying. Savitskaya has established a total of

18 world aviation records. In August 1982 S. Savitskaya, a product of a DOSAAF flying club, was a member of the crew of the Soyuz T-7 spacecraft, becoming the world's second women cosmonaut in space. She was awarded the title Hero of the Soviet Union for her courage and bravery.

Many DOSAAF pilots, engineers, and technicians have also been awarded government decorations for their great successes in military and patriotic indoctrination of youth. They include A. Yonushas, head of the Kaunas Aviation Sports Club, and flight leaders I. Goncharenko (Volchansk DOSAAF Pilot School), A. Volkov (Zaporozhye Flying Club), and V. Andreishchev (Voronezh Flying Club).

I should like to make particular mention of the job done by the Rostov Flying Club -- initiator of socialist competition in honor of the 60th anniversary of establishment of the USSR. Its personnel adopted upgraded pledges and appealed to all aviation organizations to make every effort to improve the quality of flight training and to work tirelessly on military-patriotic indoctrination. This appeal evoked widespread response in the flying clubs.

The people of the flying clubs of Moscow, Leningrad, Kursk, and Yegoryevsk are working these days with great enthusiasm. A well-structured and all-encompassing system of flight training has been developed in aviation training organizations. They have modern facilities, which include aircraft simulator classrooms, laboratories equipped with the latest technical teaching devices and, finally, a large fleet of airplanes, helicopters, and sailplanes.

The sports achievements of our aviators are growing year by year. In the last 10 years alone 582 records were established in the USSR, including 311 world records. The Soviet Union is today the world's leader in number of records registered with the International Aviation Federation (FAI).

In honor of the 60th anniversary of establishment of the USSR, DOSAAF sports aviators pledged to set 60 records in 1982. And they kept their word. By 1 October they had set 68 records, 60 of which surpassed the world records. In this jubilee year V. Smolin became the world champion in precision flying, and L. Korycheva became the world parachute champion. Soviet sport fliers were awarded the Cup imeni P. N. Nesterov for their team victory at the world championships and the Aresti Cup for the individual world aerobatics championship. All this indicates the high level of development of the aviation sports in this country and their mass participation.

Model airplane building is very popular. Fine facilities have been built in Moscow, Sverdlovsk, Simferopol, Kiev, and other cities, enabling schoolchildren, students and working youth to take part in this sports activity.

There have been successes in the development of model airplane building and flying, and these successes have been considerable. For example, at the wire-controlled model airplane world championships in Sweden, masters international class V. Onufriyenko and V. Shapovalov not only won the competition but also set a new world record. And victory at the Seventh Wire-Controlled Scale Model Aircraft Championships was won by V. Kramarenko, a design engineer from Kiev. Unquestionably the achievements of the "small aviation" designers are also manifested in the successes of the Soviet Air Force.

Much has been accomplished. But much still remains to be done, implementing the decisions of this 9th All-Union DOSAAF Congress, which will be a new landmark in boosting the level of the diversified activities of the Order of Lenin and Order of the Red Banner Voluntary Society for Assistance to the Army, Air Force, and Navy.

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NEW INITIATIVES IN AERIAL COMBAT DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 32-33

[Article, published under the heading "The Reader Suggests," by military pilot 1st class Capt Yu. Priymak, commander of an excellent-rated flight: "If One Thinks in an Innovative Manner...."]

[Text] Once I was told the following incident. Two 2-fighter flights met in a mock air battle. The first was led by a military pilot 1st class, while the second was led by a military pilot 2nd class, a senior lieutenant, who had become a flight leader a few months back. Interestingly enough, he and his wingman emerged victorious in this "battle."

Analyzing the engagement, I reached the conclusion that the secret behind the victory by the young air warriors over more highly trained ones lay in the old application of a nonstandard countermaneuver. The senior lieutenant and his wingman executed an oblique loop, ended up above the "adversary" and, swinging the fighters to the right from a more advantageous position, executed an accurate missile "firing."

It would seem that the first flight also performed competently in the given conditions: with an encounter on such courses, a chandelle to the left was the most advisable for it. The flight leader assumed that the attacking fighters would follow him, "undercutting" the flight trajectory. But the senior lieutenant proceeded differently. He and his wingman had long ago mastered this maneuver and, under the guidance of the flight and squadron commanders, had devised several variations of attack in similar conditions. All this came in handy. As a result the major, acting without taking into consideration the specific situation, was attacked and failed to gain the victory he could have counted on in combat with less prepared adversaries.

Usually, when preparing for air combat, a pilot first rehearses a number of standard offensive and defensive maneuvers, which subsequently give him a foundation in highly-maneuverable air battles. This is a logical stage in our development. But the practice of executing one and the same maneuvers, engagement after engagement, during repeated rehearsal and drill, has hardly proven effective. As experience indicates, such an approach to training thwarts a pilot's initiative and leads to predictable routine. A pilot must get away from

this. The experience of the men who fought in the Great Patriotic War convincingly attests to its fatal consequences.

One of the rules of A. V. Suvorov's "science of winning" is "suprise and win." Honored USSR Military Pilot A. Ivanov states in his book "Skorost', manevr, ogon'" [Speed, Maneuver, Fire] that tactics is the most important element in air combat. Victory is gained by he who is first to figure out the adversary's plan and who knows the capabilities of the adversary's aircraft and weapons. It is essential to structure one's maneuver according to the situation, in order to come out in the most favorable position. All this is done not instantaneously but is acquired through the course of painstaking search and analysis of past battles -- one's own and those of one's comrades in arms.

New tactics should be not simply thought out but carefully calculated, simulated, and their expediency proven. Each must be thoroughly rehearsed on practice flights, so that it becomes a natural response to the pilot and does not cause any difficulties in execution.

In practice sometimes only the first two stages of mastering a new technique are carried out. At brief tactical exercises pilots frequently suggest interesting, original variations, but unfortunately they are not always backed up by calculations and are never air-tested. But the most interesting of these could be discussed at the methods council and be given the go-ahead.

Methods of waging aerial combat depend directly on the capabilities of the aircraft, their weapons and equipment. A tactical device should be of a concrete character, calculated for a specific adversary. An action variation which has proven effective against one aircraft may prove to be useless and even harmful in air combat against another.

Thrice Hero of the Soviet Union A. I. Pokryshkin holds a like opinion. In his book "Nebo voyny" [Sky of War] he comments that rather extensive regions of nobody-wins outcome have always been characteristic of the counterpart aircraft flown by the leading countries. This fact imposed greater demands on the pilot's tactical and weapon training. Only the fighter pilot who had thoroughly mastered tactics could force an adversary to enter that small loss envelope by means of a skilled and surprise maneuver, by utilizing one's advantages, even if insignificantly small. Therefore when improving air combat skills (repeated rehearsal of scheduled drills), in my opinion a pilot should be assigned a specific mission. For example: "Conduct air combat with a certain fighter with engagement on a head-on-course." Then when preparing for the training flight, the pilot will independently suggest maneuvers which he will execute (taking into consideration the strong and weak points of both aircraft, his and the adversary's), and he will unquestionably attempt to prove the virtues of the selected tactics. It seems to me that preparation of this kind will foster the development of creative initiative and flexible tactical thinking in pilots, and will force them to seek new tactical devices needed to gain victory in air combat.

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TRAINING AVIATION SPECIALISTS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 34-35

[Article, published under the heading "Military Educational Institution Affairs," by Engr-Lt Col E. Lepeshev: "Creative Finds by Innovators"]

[Text] Engr-Lt Col V. Ul'yanov took his place at the instructor's console and assembled sheets of paper bearing questions and code symbols. Surveying the men's faces and satisfied that the students were ready for the class, the officer gave the command: "Begin...."

Immediately multicolored digital displays lit up on the consoles of the instructor and the trainees, indicating what questions the future aviation technicians were answering at a given moment, and indicating the completeness of the answer. Preliminary and final marks on the topic which had just been completed were given. Officer Ul'yanov needed slightly more than 10 minutes to question the men, after which he proceeded to discuss new material.

We should note that machine testing, which is extensively employed literally in all our training curricula, in the classrooms, and the departments of the military aviation-technical school is not any particular novelty. It is employed in other schools and in line units. Specialists in electronics and automatic control are familiar with the circuitry of such devices. One can always see them at the Exhibit of Achievements of the National Economy of the USSR and at specific-topic exhibits of projects of our district's efficiency innovators and inventors. But the innovators themselves select and develop design solutions when designing electronic simulators and testing machines as well as methods of utilizing already existing consoles and equipment mock-ups. Here too is opened up an inexhaustible source of innovative finds and original solutions. Thanks to these we are able regularly to update training-simulator and teaching equipment, which is an efficient aid to teachers and instructors.

Take, for example, that same electronic testing machine developed by Engr-Lt Col V. Ul'yanov, Engr-Maj A. Matyunin, and other officers. The need for it was dictated by practical realities, because in the past, before proceeding with the next lecture, teachers could question in detail barely two or three students. As a result they were not always clearly enough aware of the gaps in the knowledge of a given student, and consequently were unable promptly to tell him how to eliminate these gaps.

Equipment has made it possible to correct these deficiencies to a certain degree. The officers prepared from 15 to 20 questions on the principal topic and broke them down into groups of answers, where only one out of five is correct. The questions encompass not one but several covered topics, which forces the students to study their notes from past lectures and to consult the technical literature more frequently, for they know that time for answering is greatly limited, and a clever guess is useless.

Equipment developed by efficiency innovators is used not only by technical course instructors. A unique testing machine which helps individually and group-test the knowledge of general military regulations was designed and built by innovators under the guidance of Engr-Col A. Kovbas. Electronic equipment in the truck training classroom simulates complicated road situations and failure of truck parts and assemblies. Engr-Lt Col M. Tyaglo and other teachers use this equipment not only to test knowledge but also as a teaching aid.

Interesting design proposals have been born in the process of seminars, laboratory projects, and examinations. In the course of a discussion, for example, an instructor determined that some of the men had too vague an idea about the physical meaning of the "shimmy" phenomenon and methods of combating it. One of the students in another group was unable to give an intelligent explanation of surge or the operating principle of safety devices.

It is best to explain in a graphic manner that which is not understood. Capt Tech Serv P. Taraday, an experienced practical training instructor, made a simple device in which a moving belt shows how and why oscillating motions develop in the nose wheel of a landing gear, and a cross-sectioned hydraulic damper to show how these oscillations are damped. They put an entire unit alongside this display and indicated the adjustment points and inspection points.

A simulator-testing machine in the engine course not only shows the direction of air flow in an aircraft's air intake but also accompanies surge with a characteristic vibration, simulating a compressor operating in off-standard operating conditions. The students like using this and other simulators and more fully master complex subjects.

The results of innovator efforts are extensively discussed during efficiency innovator and inventor project months. As a rule, these are held in March and October. In the spring because semester classes are ending at the school and a brief period of reduced activity occurs, during which individual innovators and innovation teams consult with instructors and engineers without detriment to training time. They have at their disposal the shops and laboratories, tools, test equipment and instrumentation. A similar short pause in training occurs in the fall, when first-year students report for duty. Experience has shown that these months are the most productive for innovators.

Efficiency innovators frequently gather to exchange experience and know-how and to tell about their ideas. This helps prevent parallel work on one and the same topic in different courses of study and departments. Dissemination of advanced know-how fosters most extensive adoption of valuable suggestions.

For example, simulators appeared in classrooms as a result of close collaboration among specialists from different courses of study -- aircraft cockpits in which students rehearse procedures during preliminary and preflighting preparation of aircraft, engine, instruments, electronics, and armament for flight operations. One can also seek to find defects introduced by the instructor and to correct them with the aid of portable instruments and test devices.

Innovators also think about how better and more conveniently to position bulky equipment in classrooms so that it produces maximum benefit and does not obstruct the room. Engr-Maj V. Belezko and Engr-Capt S. Bezrodnyy, for example, designed a vertical rotating platform on which they placed an aircraft engine. It takes up very little space in the classroom when assembled and is very convenient for showing components, lines, adjustment points, etc to the entire class (and not to individual small groups, as in the past).

Last year, a jubilee year, useful suggestions were submitted by clever innovators in all courses of study. Remembering the demands of party and government for thrift and economy, they developed unique installations, display stands, and assemblies, utilization of which provides visual aid to study and at the same time makes it possible to operate not an entire system but only its components. I shall illustrate this with an example.

In the area of study covering built-in testing, there are a great many analog computers and units. Although this is teaching equipment, it has only so long a life, limitations, and requires tuning and adjustment. In the past we had to switch on the entire equipment in order to check a single unit. The other components were operating unproductively, using up unnecessarily part of their service life. Now we disconnect a specific unit from the system and check it separately on innovator-fashioned panels. This innovation alone has produced considerable savings in electricity.

Similar savings are obtained from intelligent utilization of TV sets, tape recorders, and filmstrips. Automatic devices which switch off the generator room on a time schedule help save electric power. These devices were also built by efficiency innovators -- WO A. Mokhov and other aviators.

The school's innovators do not keep their know-how a secret but share it at technical conferences and report what they are doing in news bulletins and wall newspapers. Activists publicize the achievements of such innovators as Engr-Lt Col A. Smirnov, who received a commendation from the commander in chief of the Air Force for his aggressive efficiency innovation efforts, officers I. Suvorov, S. Bezrodnyy, V. Baturintsev, and others.

Innovators marked the year of the 60th anniversary of establishment of the USSR with worthy gifts. They submitted more than 140 suggestions, the majority of which fall within the category of valuable suggestions. Almost all have been adopted and are greatly helping train future aviation specialists.

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BRAKING PARACHUTE OPENING ON TAKEOFF DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) page 35

[Article, published under the heading "Analyzing an Accident Precondition," by Maj V. Usol'tsev: "Everybody Committed a Little Violation"]

[Text] Scheduled training flights were in progress in the squadron. Aircraft technician officer V. Kuzovlev, standing on the flight line, had a clear view of his fighter taxiing onto the active. Soon the aircraft began its takeoff roll. Just as it was about to lift off and surge steeply upward, something happened: the drag chute had fallen out of its housing.

Primarily to blame for this was Senior Lieutenant Technical Service Kuzovlev: he was responsible for the proper functioning, quality of preparation and combat readiness of the equipment. Had the officer not fully performed his duties? It seems he had not. But why?

Kuzovlev is no newcomer to aviation. He is a specialist 1st class and is well-acquainted with his aircraft and flight safety guideline documents. For a number of years running the officer had had a flawless safety record. Kuzovlev had frequently been cited as an example to emulate.

High praise of one's performance inspires some people to strive to to achieve new, higher levels of professional expertise, while in others it dampens their ardor and dulls their sense of responsiblity. Relying on the experience and knowledge they have acquired, they are of the opinion that they can work at a half effort and not check their own actions. Without going into the technical details of the incident, we shall note that this dangerous situation occurred precisely due to this latter attitude.

We must also state the following. Leading performers are always given more trust. but trust should not exclude rigorous verification of their work performance. But in this subunit it seems that this point was simply forgotten for some time. In view of Kuzovlev's experience and conscientious attitude toward his job, his superiors only perfunctorily checked his actions. And yet flight safety documents rule out such an approach to things.

Violation of the requirements of these documents contains the second component of the cause of this gross error. Lack of verification had a weakening effect on officer Kuzovlev, engendered a certain self-assurance in him and caused him to depart from the regulations governing flight operations. Perhaps this happened only once over an extended period of service, but it did happen.

Nor can we ignore the following. A similar incident had previously occurred in the squadron. Did it serve as warning to the deputy commander for aviation-engineering service, the aircraft ground technicians and maintenance chiefs of the flights, who are directly involved in readying fighters for air operations? They should have held additional drills and training classes with the specialists, and they should have focused the attention of personnel on the need for carefully performing the brake chute rigging operations. Proper significance was not attached to this incident in the subunit, as is apparent.

Therefore another "surprise" occurred. The pilot certainly could have prevented it if he had checked to ensure that the brake chute doors were securely shut. Finally, there was also another possibility: vigilance by the technical inspection station specialists. But both the pilot and the aviators manning this station did not perform adequately.

In short, every individual involved in readying the fighter for flight has violated existing aircraft preparation procedures. The result was detriment to combat training, wasted engine time logged, wasted fuel burned, and waste of other resources. This represents considerable cost.

On this occasion the response to the dangerous incident in the subunit was correct. The incident was analyzed in detail with all flight and engineer-technical personnel. Officer Kuzovlev and the other guilty parties were punished. Drills were held on packing the brake chute in its housing and securely shutting the doors, and on inspecting performance of these operations for correctness. Superiors began checking the work of the technicians and mechanics more rigorously. In addition, a great deal was done to increase the technical knowledge of the aviation specialists and to increase their professional vigilance.

Officer V. Kuzovlev drew the proper conclusions from his error. Today, just as prior to the annoying mistake, he is conscientiously performing the duties of an aviation technician.

Appropriate measures to teach efficiency, discipline, and to improve the proficiency of aviation specialists were also taken in the unit's other subunits. They have produced positive results. There has been a significant improvement in the quality of readying aircraft for flight operations and servicing them between duty shifts.

Here are some facts which confirm this. Lt Tech Serv V. Trushin, inspecting his fighter prior to releasing it for flight operations, spotted a defect in a hard-to-reach place. Senior aviation mechanic WO G. Soshin also distinguished himself.

The commanding officer awarded valuable gifts to these proficient and vigilant men. Their skilled actions have been cited as an example for all personnel to emulate. The requirements of flight safety documents are now being unswervingly observed in the subunits. And flight operations gain a great deal from this.

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TRAINING SIMULATORS FOR SPECIALISTS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 38-39

[Article, published under the heading "Know-How of the Best Into the Combat Arsenal," by Engr-Lt Col A. Makarov: "Training Simulators for Aviation-Engineering Service Specialists"]

[Text] Winter combat training is in full swing. In spite of bad weather, aviators are successfully performing their assigned combat training tasks and are working persistently to improve their professional skills. Simulator activities are benefiting them greatly. Aviation-engineering service specialists practice performing complicated technical operations on these simulators, acquiring skills in servicing aircraft equipment. Thanks to such exercises and practice drills, aviation-engineering service personnel have the opportunity continuously to improve their level of skills and to save training time, wear and tear on equipment and weapons, and save fuel and lubricants.

Air Force inventors and efficiency innovators are making a worthy contribution toward developing new and further improving existing simulator equipment and lab installations. Many of these are experts in their area of specialization, highly-skilled engineers, technicians, and mechanics, who have earned the honored privilege of displaying their work at the Exhibit of Achievements of the National Economy of the USSR, in the Radioelectronics, Machine Building, and other exhibition halls. According to the conclusion reached by experts, the design and construction of their devices are at a high scientific and technical level. They are being used in the units and subunits for aviator training.

A training simulator for studying operation of ground external power sources and fighter hydraulic system servicing, developed by efficiency innovators A. Kovalenko and I. Verevskiy, are very popular with aviation specialists. A "traveling wave" light display makes it possible to simulate hydraulic mains, which enables a large group of specialists to work on the simulator. In demonstrating the operation of system components and assemblies, the instructor, touching metal contacts with his pointer, switches on the light display simulating movement of hydraulic fluid in the lines. The simulator is simple in construction and convenient to use. But the main thing, in the engineers' opinion, is that it enables them to reduce by 20 percent the time allocated for studying the topic. This device greatly assists officers in holding seminars

and technical analyses, as well as in preparing for examination sessions.

Innovators from other military units also pay serious attention to matters pertaining to studying and improving servicing of hydraulic systems. For example, leading specialists officers V. Bortnichuk, A. Yegorov, and V. Reshchikov, higher military aviation engineering school activist efficiency innovators, built a training simulator with the aid of which one can record and study with a high degree of accuracy the static and dynamic characteristics of aircraft servo control units. As experience indicates, their parameters can change in the process of operation, which of course affects the quality of system operation and can lead to malfunctions. Practice sessions on the simulator enable specialists to acquire skills in preventing malfunctions.

The device designed by these officers includes a servo control unit, a pump station, a power cabinet, an oscilloscope, a low-frequency oscillator, an electronic recorder with power supply, and other instruments, assembled on analogy with the components of a portion of an actual hydraulic system. The bench contains a main and backup system. Remote electric sensors placed in the delivery and pressure lines are connected to the oscilloscope and recorder. The oscillators generate signals which cause the servo control unit valves to displace, which causes the valve stem to deflect, whereby a specific input and output signal correspond to each angle of deflection. The obtained data are recorded on monitoring and recording equipment. By varying the signal amplitudes, the requisite characteristics can be induced in the servo control unit, and parameter changes can be visually observed.

This piece of equipment is used in conducting laboratory and scientific research activities. It can also be utilized by specialists in line units and maintenance organizations to test servo control units and hydraulic amplifiers of various types. Employment of this equipment makes it possible significantly to reduce labor expenditures in replacing servo control units. The recording equipment rapidly processes information obtained from the remote sensors.

Experience in operation and maintenance of aircraft equipment has suggested to innovators ways to design and build simulator devices for training young aviation-engineering service specialists. Such equipment helps ground specialists make the most optimal decisions in quickly and correctly determining the causes of malfunctions, correcting them and taking effective preventive measures. One such simulator was recently built by higher military aviation engineering school enthusiasts. This valuable innovation is helping students reinforce theoretical material before beginning laboratory activities.

A simulation unit for studying algorithms and operation of aircraft electronic computer devices was developed by a team of officers under the direction of Engr-Lt Col P. Khomenko. It consists of an aircraft simulator, block units of equipment, coupling devices, and training session performance monitoring devices. This simulator is also being used with success by flight personnel in the process of rehearsing on the ground special drills on the most complex types of combat employment of the aircraft system.

We could also mention other valuable contributions by Air Force innovators, which are helping Air Force personnel improve their professional skills and increase their combat readiness. Officers V. Kozhokhin and V. Gordeyev, for example, designed and built a device to simulate the physical processes taking place in the landing gear when an aircraft is taxiing across uneven ground. Utilizing this device, aviation-engineering service specialists can observe change in these processes in relation to taxiing speed, and can also measure the vertical and horizontal stress loads on the landing gear. The innovators endeavored to reproduce with maximum clarity the operation of an aircraft's landing gear. Toward this end they mounted a landing gear on a frame and placed under the landing gear a rotating drum containing a circular and a sinusoidal path. Reduction of loading on the gear caused by wing lift is simulated by a rubber shock absorber, with load on the landing gear controlled by a carriage traveling on vertical guides. Slide-wire resistors are used to record carriage movement, as well as degree of shock absorber squeeze and drum cam profile. The vertical and horizontal components of forces acting on the landing gear are measured with strain gauges. These and other devices almost totally simulate an aircraft's takeoff roll, landing roll, and landing, and create the effect of actual landing gear operation.

Also meriting attention is a combined laboratory setup built by airmen under the guidance of officer O. Nezhivov. It is designed to study the operation of discrete-component electronic circuits in modular and integral configuration. These are its principal functions. In addition, specialists can study the operation of standard discrete-component circuits -- amplifiers, pulse generators, flip-flops, and logical elements. The device can also be effectively utilized with simultaneous study of four regular-production modules: DC and AC current amplifiers, modulators and demodulators, magnetic amplifiers, as well as in studying the operation of analog and digital integrated microcircuits.

Air Force innovators are working with a party-minded sense of responsiblity on improving training facilities, giving considerable assistance to aviation personnel in accomplishing the difficult tasks of the new training year.

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COMMENTARY ON SPACECRAFT RENDEZVOUS PROBLEM

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 40-41

[Article, published under the heading "Support of Space Missions," by Candidate of Technical Sciences O. Georgiyev: "Rendezvous in Space"]

[Text] One of the most interesting problems of maneuvering in orbit is that of rendezvousing two spacecraft. Usually one spacecraft plays an active role while the other plays a passive role in accomplishing this. A typical example of such distribution of roles is the "Soyuz" space transport or the "Progress" supply ship (active spacecraft), rendezvousing with the Salyut space station (passive spacecraft). In our subsequent discussion we shall be referring precisely to this space program.

The procedure of solving the problem of rendezvous or, more precisely, a space mission with a rendezvous segment, includes several phases. The first is performed before the spacecraft is launched into orbit, and is the preparatory phase. In this stage the space station, which is already in orbit, fires its engine in order to change or adjust its orbital movement, so that at the moment of launch the station's orbital parameters and its position in orbit meet specified conditions. The preparatory stage is called formirovaniye montazhnoy orbity [establishing an alignment orbit].

In the second phase, the spacecraft launch phase, the spacecraft does not yet proceed to perform its active role -- it is merely a rocket booster payload. But a number of items ensuring successful rendezvous are handled in this phase. In particular, the problem of inserting the spacecraft virtually into the plane of the alignment orbit is solved (otherwise costly power-consuming maneuvers would be required during approach in order to match the orbital planes of the rendezvousing spacecraft). In addition, in the launch phase a specific range of distance between the passive and active spacecraft at the moment the latter is launched into orbit is ensured. Problems of this stage are solved by launch date and time selection.

Proceeding with description of the rendezvous phase, actually performed by the active spacecraft, we shall clarify the physical principles involved in solving this problem with an example. Let us assume that at the initial moment the station is at point P in a circular alignment orbit at an altitude of H_P=350 km,

while the spacecraft is in a circular insertion orbit with an altitude H_a= 200 km (Figure 1) [not reproduced]; The periods of these orbits are T_p=91.54 min and T_a=88.49 min respectively. Let us say that the spacecraft's position in orbit (point A) is a quarter of a revolution behind the station (Φ_0=90°). Angle Φ is called phase mismatch, or phase; a distance along the orbital path of approximately 10,500 km corresponds to the value of initial phase Φ_0=90°. Let us assume that we have been assigned the problem of completing the rendezvous in precisely 10 station orbital revolutions.

We shall assume that the spacecraft does not maneuver, that is, it travels in its initial insertion orbit during the time allocated for accomplishing the rendezvous. Then after 10 revolutions or 915.4 minutes, the station will once again take its initial position P in the alignment orbit, while during this same time the spacecraft will complete 10.34 revolutions in insertion orbit, since its orbital period is less than that of the alignment orbit. The 0.34 revolution beyond 10 complete revolutions corresponds to degree $\Delta\Phi$=122°. Thus the spacecraft not only makes up the initial 90° phase lag behind the station, but will also run 32° ahead of it.

The process of changing the phase mismatch between spacecraft during flight is called phasing. In our example the phasing rate (122° in 10 revolutions or 12.2° per station orbital revolution) was too great, and therefore the initial phase could be corrected after 7.5 revolutions. It is clear from this illustration that phasing rate can be adjusted by adjusting the orbital period of the maneuvering spacecraft.

A spacecraft has only one means of altering its orbital period or any other of its parameters -- its engine, which enables it to adjust the spacecraft's speed in orbit. What speed adjustments can produce the desired orbit change? In order to provide a simple answer to this question, let us assume that we are dealing with circular (or almost circular) orbits at an altitude of up to 400-500 km and that the spacecraft's orbital speed changes instantaneously when the engine fires (such a change is usually called a speed pulse or, in abbreviated form, pulse). These assumptions enable us to estimate simply and fairly accurately the effect of change in orbital velocity. We shall give the numerical characteristics for a pulse of magnitude ΔV=1 m/s.

Let us assume that the direction of the pulse is transversal, that is, coincides with the direction of orbital velocity. As a result of its action, all orbital points will move away, as it were, from the point of pulse application, with this distance being maximum after half a revolution, and will raise orbit altitude by 3.4 km, increasing the orbital period by 0.034 min.

If the pulse direction is radial (coincides with a direction from the center of the Earth to the point of pulse application), the orbit will shift in its entirety, as it were, in the direction of orbital velocity, whereby altitude will maximally increase by 0.85 km one quarter of a revolution following the pulse, and will maximally decrease by 0.85 km three quarters of a revolution following the pulse, while the orbital altitude will remain unchanged at the diametrically opposite point, as will the orbital period.

If the direction of the pulse is normal to the orbital plane, after the pulse the orbital plane will turn around a radial direction, and a maximum lateral orbit displacement of 0.85 km will occur after one fourth and three fourths of a revolution following the pulse (the direction of displacement after a fourth of a revolution will coincide with the direction of the pulse), while orbital altitude and periods will remain unchanged.

With a change in pulse direction to the reverse, changes in orbital characteristics will also reverse in sign. In addition, if the velocity pulse is increased (or decreased) severalfold, the changes in orbital characteristics will equally increase (or decrease). Since any pulse can be represented as the sum of its radial, transversal, and normal components, change in orbit from the effect of such a pulse can be represented as the sum of changes from the effect of each.

Returning to the matter of phasing, we now see that change in the orbital period of the active spacecraft is accomplished by a pulse with a transversal component.

Up to this point we have been speaking of correction of the phase mismatch between spacecraft. But the fact of rendezvous is recorded at the moment when phase, altitude, and lateral mismatches become zero, that is, the relative distance between spacecraft becomes zero. We shall use an example to show how altitude and phase mismatches can be simultaneously eliminated.

Let us assume that under initial conditions corresponding to Figure 1, a spacecraft after three fourths of a revolution on its irig'nal injection orbital path is changed by a transversal pulse ΔV_1 into an elliptical orbit (Figure 2) [not reproduced]. At the point of pulse application the orbital altitude remains unchanged and equal to H_a, while at the diametrically opposite point altitude changes to $H_1=H_a+3.4 \times \Delta V_1$; the orbital period becomes equal to $T_1=T_a+0.034 \Delta V_1$.

Having completed a certain whole number of revolutions N in the elliptical orbit, the spacecraft changes its orbit again by a transversal pulse ΔV_2, so that its altitude at the diametrically opposite point becomes equal to alignment orbit altitude H_p. The magnitude of the second pulse is determined by the formula

$$\Delta V_2=\frac{H_p-H_1}{3.4}.$$

In conformity with this formula, the orbital period following application of the second pulse is equal to: $T_2=T_1+0.034 \Delta V_2=T_a+0.034 (\Delta V_1+\Delta V_2)=T_a-0.01 (H_p-H_a) \approx 90$ min.

Finally, at the point of tangency between the alignment orbit (point P) and the spacecraft orbit obtained following the second pulse, the spacecraft's orbit is changed once again by a transversal pulse

$$\Delta V_3=\frac{H_p-H_a}{3.4},$$

and thus its altitude at the opposite point is also brought to H_p. This last pulse completes the spacecraft's transition from its initial insertion orbit into the alignment orbit.

We shall determine the time of spacecraft flight from the initial position to the point of transition into the alignment orbit. In the course of this flight the spacecraft covers three fourths of a revolution along its insertion orbital path ($0.75T_a$=66.37 min), N complete revolutions in its elliptical orbit with period T_1 (NT_1), and half a revolution in an elliptical orbit with period T_2 ($0.5T_2$=45 min). Since the point at which the rendezvous is to take place should be reached by both spacecraft simultaneously, the following conditions must be met:

$$10T_p=0.75T_a+NT_1+0.5T_2=0.75T_a+NT_a+0.034N\Delta V_1+0.5T_2.$$

After substituting numerical values, this condition is transformed to the following form:

$$\Delta V_1=\frac{804.03-88.49N}{0.034N}.$$

The obtained formula makes it possible, with a selected N, to determine quantity ΔV_1, and after this the remaining parameters of the rendezvous problem solution with existing formulas. These parameters for three values of N are contained in the following table.

Table

N, Revolutions	ΔV_1, m/s	ΔV_2, m/s	ΔV_3, m/s	H_1, km
8	353	-309	44	1401
9	25	19	44	285
10	-238	282	44	-609

A plus sign on ΔV signifies that the pulse is directed along the orbital velocity (acceleration), and a minus sign -- in the opposite direction (deceleration). Common sense suffices to select an acceptable value of N. First of all a case with N=10 is virtually impossible, since movement with negative H is impossible. A solution for N=10 is energetically inadvisable, since the total change in orbital velocity, or the total pulse, in this case is 706 m/s as compared with 88 m/s when N=9. A greater combined pulse means greater engine fuel consumption, and therefore as a solution we select the most economical, or energy-optimal, variant N=9.

The above example is only a partial, simplified model of solving a rendezvous problem, but it enables one to understand that solving such a problem depends to a significant degree on the initial data (initial phase and altitude mismatches between spacecraft) and the flight configuration adopted for accomplishing rendezvous (positioning of pulses in the revolutions, time extent of rendezvous phase). Practical experience not only engenders a diversity of initial data but also imposes fairly rigid requirements and limitations on the rendezvous flight configuration.

In our illustration the spacecraft engine was first fired on the first revolution in the insertion orbit. Can this actually be done in practice? In principle yes, but such haste might prove to be unwarranted. The fact is that a spacecraft is injected into an orbit the parameters of which as a rule differ to some degree from planned. And in order to determine the actual parameters of an insertion orbit it is necessary to make trajectory measurements and process them. And this as a rule requires the spacecraft to pass twice over a command-telemetry station. Then it is necessary to solve the rendezvous problem and transmit the results to the spacecraft in a form "understandable" to the spacecraft control system. Thus for practical purposes the first pulse should not be fired until the third time around. In view of all the operating peculiarities of ground and spaceborne control systems, it is considered most advisable to fire the first pulse not sooner than the fourth revolution of its mission to rendezvous with the Salyut.

The above approach is also valid in subsequent procedures, for any pulse does not take place as we calculated it, but with certain errors. Furthermore, if we do not take new measurements of the spacecraft's orbit, our current knowledge of its movement is based on the results of processing measurements in the past, "extended" into the present. Such extending contains errors, since we do not know with absolute accuracy the environmental forces acting on the spacecraft, and we utilize only a model of such forces in our calculations. In addition, the measurements taken in the past also contained some error. As a result, we always have knowledge of the spacecraft's orbit with certain error, and this error increases with time, if we have no "fresh" measurements. Hence a practical conclusion -- our knowledge of the orbit should be refined following the first rendezvous pulses. For the Soyuz the new measurements are taken on its fifth and sixth revolutions, while after this, right up to the 13th, it is out of line-of-sight from ground tracking stations located on Soviet soil. This period (it is called "glukhoy vitok" [blind revolution]) is normally utilized for the crew to sleep, while the status of on-board systems is monitored by the spacecraft's test stations. From the standpoint of ballistics the "blind revolution" makes an entirely constructive contribution toward solving the rendezvous problem (we shall recall N phasing revolutions in the above example).

Another limitation is altitude. In practice it is considered undesirable for the minimum orbital altitude to drop as low as 130-150 km.

We shall end our discussion with this and note that we have been discussing the rendezvous phase, which is usually called dal'neye sblizheniye [far-out approach]. This is followed by autonomous approach, which completes practical solving of the rendezvous problem.

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COMMENTARY ON MILITARY AVIATION IN FALKLANDS CONFLICT

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, Feb 83 (signed to press 3 Jan 83) pp 46-47

[First part of an article, published under the heading "Abroad," by N. Novichkov: "Combat Aviation in the Anglo-Argentine Conflict"*]

[Text] The Anglo-Argentine conflict erupted after Argentine troops were landed on the Falkland (Malvinas) and South Sandwich Islands, as well as the island of South Georgia, and ran from April to June 1982. The Argentine Government repeatedly proposed compromise solutions to the conflict, but the United Kingdom, supported by the United States and NATO, would have none of it. Imperial arrogance pushed London into an extremely dangerous aggravation of the international situation. The Conservative government established a total sea and air blockade within a radius of 320 kilometers from the Falkland Islands, and subsequently 32 kilometers from the coast of Argentina, and launched extensive combat operations in the South Atlantic.

At the beginning of April the largest carrier task force since World War II was dispatched to the Falklands, a force which contained two thirds of the Royal Navy's warships. The task force included two ASW carriers, the "Hermes" and the "Invincible," two general-purpose nuclear and two diesel submarines, 16 light cruisers, destroyers and guided missile frigates, five amphibious warfare ships, including the assault ship "Fearless," as well as 14 auxiliaries. Initially the carriers carried 20 Sea Harrier VTOL embarked aircraft (the 800th, 801st, and 899th squadrons) and an approximately equal number of Sea King and Lynx helicopters. An additional 10 helicopters were carried by other ships in the task force. By the time the British went ashore onto the Falklands on 21 May 1982, more than 80 British naval combatants and auxiliaries were concentrated in the South Atlantic.

In view of the great distance from the theater of military operations to the home islands (more than 12,800 km), the British made use of a U.S. military base on Ascension Island, 5,500 km from the Falklands, for transporting troops and arms. British ships damaged in the fighting were also taken there for repairs. Military hospitals to treat wounded were set up in the port cities of the Republic of South Africa.

* Based on materials in the foreign press.

Following the outbreak of hostilities, 10 Vulcan strategic bombers were redeployed to Ascension Island, as well as 15 Victor aerial tankers, and MR2 Nimrod ASW aircraft. In mid-May an additional 14 Sea Harrier VTOL aircraft were added to these. Thus the total number of VTOL aircraft in the combat zone rose to 43 (28 Sea Harriers and 15 Harriers).

In order to increase the duration of continuous patrol along the task force's route and to provide up to 19 hours of ASW, Nimrod aircraft were hastily fitted with midair refueling systems, and flew 150 combat sorties from Ascension Island. Four modified C-130 transports were used as tankers. Together with VC10 aircraft, they airlifted 5,600 troops and 6,800 tons of various supplies to Ascension Island.

At the commencement of combat operations the Argentine Navy totaled 39 warships: the multirole aircraft carrier "Veinticinco de Mayo," 14 guided missile and ASW frigates and destroyers, 9 smaller escort ships, 4 diesel submarines, 5 amphibious warfare ships, and 6 minesweepers. Argentina also had 34 fast attack craft and 35 auxiliaries. Except for the carrier, all Argentine warships were inferior to the British ships in missile and artillery armament as well as other combat means.

After British Lynx and Wessex helicopters, firing AS12 and Sea Skua missiles, damaged or sunk the submarine "Santa Fe" and 2 escort ships at the commencement of combat operations, and the nuclear submarine "Conqueror" torpedoed the cruiser "General Belgrano," Argentine naval forces took virtually no part in the fighting. The entire brunt of the fight against the carrier task force and organization of support for the Argentine ground troons on the Falklands was borne by tactical air and naval avation.

The Argentine Air Force contained 14 squadrons, armed with U.S., French, British, and Argentine-built aircraft: a bomber squadron (10 B-62 Canberras), 8 fighter-bomber squadrons (75 A-4P Skyhawks, 26 Daggers,* 48 MS760 Paris, 21 Mirage-3E), 2 counterinsurgency squadrons (80 Pucara 1A-58A and 1A-58B light attack aircraft), a reconnaissance squadron (47 Guanquero 1A-35 aircraft), and 2 helicopter squadrons. The Air Force totaled in excess of 450 aircraft, including 180 bombers and fighter-bombers, and 20 helicopter gunships. In addition, there were 5 transport squadrons (53 fixed-wing and 9 rotary-wing aircraft), 3 auxiliary squadrons (55 fixed-wing and rotary-wing aircraft) and several training squadrons (more than 100 aircraft).

Naval aviation included 1 carrier-based squadron (22 combat aircraft, including 16 A-4Q Skyhawks, and 4 helicopters), 4 land-based squadrons, and several transport squadrons (a total of approximately 130 aircraft).

At the beginning of 1982 Argentina received 6 French Super Etendard embarked aircraft (Photo 1) [not reproduced] and 5-6 AM39 Exocet air-to-surface antiship missiles, which fly a flat trajectory, skimming close to the water surface.

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* Mirage-3 aircraft built in Israel under license.

The Argentine pilots, whose experience involved flying A-4Q Skyhawk embarked aircraft, were not yet trained in landing the Super Etendard on an aircraft carrier. A training simulator made by the French firm of Thomson-CSF to train pilots on this aircraft was scheduled to be delivered toward the end of 1982. Apprehensive about damaging even one of the newly received aircraft during a carrier landing, the Argentine command authorities employed the Super Etendard from land airfields, which limited their combat effectiveness. The aircraft carrier did not take part in combat operations.

When hostilities began, approximately 90 percent of Argentina's 278 combat aircraft were fit for duty, including 6 Super Etendards, 20 Mirage-3E, 25 Daggers, 76 A-4P and A-4Q Skyhawks, 8 Canberras, and 75 Pucaras. In addition, Argentina was operating 9 Neptune reconnaissance aircraft, 9 C-130 Hercules transports (2 as aerial tankers), 2 KC-130 tankers, several dozen (Aeromakki) [phonetic] MB326 and MB339 trainers and light attack aircraft, T-34C Turbomentors, as well as several Skyvan light transports.

When hostilities broke out, all Argentine aircraft were moved to southern continental airbases.

As is noted by the foreign press, one of the principal shortcomings of the British carrier task force was the the fact that it lacked radar early warning aircraft, which prevented it from promptly tracking low-flying targets, and significantly influenced the tactics and combat employment of Argentine air forces.

To set up the task force's outer air defense perimeter, "Sheffield" class destroyers, using their radars, provided radar early warning, patrolling 220 kilometers from the center of the task force formation, to the west of the Falklands. These ships could track high-flying Argentine aircraft at a distance of 460 kilometers from the center of the task force, that is, immediately after they took off from land airfields. A two-aircraft flight of Sea Harrier VTOL aircraft, on airborne alert 260 km west of the task force center, would be vectored by radar to the targets; these alert aircraft would be relieved every 40 minutes on a rotating basis. Carrier-based interceptors on three-minute alert were also available to scramble.

The destroyers carried GWS30 antiaircraft missile systems with long-range Sea Dart antiaircraft missiles (1 x 2 bow launchers with 24 missiles) and could engage high-altitude and other targets at ranges out to 80 km. At the same time the low-flying target detection range by shipboard radars was limited (approximately 30 km), and the GWS30 antiaircraft missile systems did not offer an effective defense against them.

Argentine naval forces had two similar-class British destroyers, and the Argentine pilots were familiar with the principal deficiencies of the GWS30 antiaircraft missile system. Therefore, on 4 May 1982 a pair of Super Etendards attacked the radar picket ships using the following tactics. The pilots flew at a height of 40-50 meters above the sea surface with sights switched off and received target designation from a high-altitude Neptune navy reconnaissance aircraft. The attacking aircraft proceeded to the missile release point at a

speed of 900 km/h. Visibility in the area was 400 meters, with cloud bases at 150 meters.

At a distance of 46 km from the British ships, the pilots climbed to 150 meters, switched on their radars for 30 seconds and got a fix on the destroyer "Sheffield" and the frigate "Plymouth." The bearing angle between them was 40°. After the antiship missile homing heads had locked onto the targets, they were fired.

At this moment the aircraft's warning systems informed the pilots that they wer being painted by radar from the frigate "Plymouth." But the two aircraft executed a turn, descending to a height of 30 meters, and flew out of range of the GWS30 antiaircraft missile systems.

The active radar homing head of one of the missiles locked onto the "Sheffield" at a range of 12-15 km, it descended to a height of 2-3 meters above the water surface, and it was detected visually only 6 seconds before hitting the ship (Photo 2) [not reproduced]. For a period of 40 seconds after the second missile was detected by the frigate "Plymouth," passive jamming was employed, preventing the missile from homing to the target.

At the end of May, in the northwestern part of Falkland Sound, 3 Skyhawks attacked the patrolling destroyer "Coventry" from a height of 15 meters. The aircraft approached the target from the west at extremely low altitude. Two aircraft were shot down, but the third executed a missile evasion maneuver and delivered an accurate bomb strike. The ship sank.

In spite of the loss of the "Sheffield" and "Coventry," the radar picket ships forced Argentine aircraft to operate exclusively at low or extremely low altitudes, which increased specific fuel consumption and limited the aircraft's already limited combat radius, requiring that they refuel in midair (frequently twice). Due to an acute shortage of aerial tankers, some combat aircraft, carrying exterior fuel tanks and without weapons, were forced to accompany attack aircraft, refuel them en route, and then return to base.

Argentine reconnaissance aircraft were unable to approach the task force and determine the coordinates of targets at its center due to the threat presented by Sea Dart missiles. Therefore attack aircraft of the Argentine Air Force, having penetrated the outer air defense perimeter, lacked accurate target designation. They independently sought out British warships in conditions of countermeasures mounted by forces in the middle defense zone -- light cruisers and escort destroyers, as well as Sea Harrier VTOL aircraft scrambled from the task force.

Aircraft penetrating to the inner defense zone were met with dense fire put up by "Broadsword" class destroyers armed with GWS25 antiaircraft missile systems firing Seawolf antiaircraft missiles (2 x 6 bow and stern launchers) for engaging low-flying multiple targets, as well as "Amazon" class frigates armed with GWS22 or GWS24 antiaircraft missile systems (1 x 4 stern launchers with 20 Seacat missiles) and "Leander" class frigates with antiaircraft missile systems of the same type (3 x 4 bow and 2 stern launchers with Seacat missiles), and light antiaircraft artillery.

After putting a landing force ashore on a captured beachhead near Port San Carlos, the British immediately deployed Rapier and Blowpipe antiaircraft missiles which, together with shipboard antiaircraft missile systems, formed an inner air defense zone.

When attacking patrolling task force escort ships near the western shore of the Falklands, Argentine aircraft would sometimes employ the following tactics. Twelve Skyhawks took part in one of the attacks. They approached the target area in 3 4-aircraft elements. The third 4-aircraft element acted as aerial tankers, did not close the target and loitered at a safe distance. The first 2 4-aircraft elements separated and attacked the target in two waves from different directions. On 12 May, however, this tactic proved ineffective in an attack on 2 escort ships. On that day the British used for the first time the GWS25 antiaircraft missile system with Seawolf antiaircraft missiles against a multiple target. This system is distinguished by a short threat reaction time (5-6 seconds) and totally self-contained operation from the moment of target detection and lockon to target destruction. Since the GWS25 can intercept two targets simultaneously, three aircraft in the first 4-aircraft element attacking the destroyers were downed immediately.

In mid-May 2 4-aircraft elements of Skyhawks attacked task force ships deployed to the east and northeast of the Falklands, which were shelling Port Stanley. The Argentine pilots used target designation from a U.S.-made AN/TPS-43 shore-based radar deployed in that area. After skirting East Falkland, advancing in two waves from a single direction, at a height of 15 meters, they attacked two British warships with the element of surprise. Two aircraft of the first 4-aircraft formation were downed simultaneously by 2 Seawolf missiles, while the remaining aircraft executed a missile-evasion maneuver, but their bombs went wide of the target. The second 4-aircraft formation, following the first, executed a sharp turn and attacked the second ship, which carried no antiaircraft missile system for engaging low-flying targets. Bombs hit the ship, pierced the deck, but failed to explode. After this, right up to the end of the conflict, Argentine pilots did not attempt to attack "Broadsword" class destroyers but chose other targets.

The British command authorities in turn, convinced of the effectiveness of the GWS25 antiaircraft missile system, began employing these ships to protect the carriers, positioning them between the northern and northeastern shores of the Falklands and the main forces of the carrier task force.

To neutralize Argentine air power on the Falklands, Vulcan bombers, carrying a 9.5 ton bomb load (21 455 kg bombs), flying singly, flew five combat sorties from Ascension Island. Jump jets also flew group attacks against the airfield at Port Stanley and dirt airstrips at Goose Green and on Pebble Island (each carrying 3 455 kg bombs or BL755 cluster bombs). To reduce the probability that aircraft would be hit by Argentine Roland and Tigercat close-in antiaircraft missile systems as well as antiaircraft artillery, the strikes on the airport at Port Stanley were delivered from medium and high altitudes. But they proved little-effective. Only a few bombs hit the runway. Right up to the end of the conflict part of the runway remained usable for Argentine C-130 transports, Pucaras and MB326 Aeromakki [phonetic]. At the same time British aircraft

destroyed more than 30 Argentine aircraft on the ground at island airfields and lost 5 of their own jump jets to ground air defense fire.

Foreign experts note that the Vulcan bomber strikes were flown more to exert psychological pressure on the Argentine Government and to display a capability to bomb the mainland. Subsequently the Vulcan bombers were used, together with Nimrods, more for sea reconnaissance duty.

(To be continued)

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